

Developing eSexual Health within the NHS

How can we optimally design, implement
and evaluate an internet-based clinical
pathway for remote testing, diagnosis,
clinical assessment, antibiotic prescribing
and partner management of sexually
transmitted infections?

2015

Submitted in partial fulfilment of the requirements of
the Degree of Doctor of Philosophy

Dr Joanne Louise Gibbs

Barts and The London
School of Medicine and
Dentistry, Queen Mary
University of London

Statement of originality

I, Joanne Louise Gibbs, confirm that the research included within this thesis is my own work or that where it has been carried out in collaboration with, or supported by others, that this is duly acknowledged below and my contribution indicated. Previously published material is also acknowledged below.

I attest that I have exercised reasonable care to ensure that the work is original, and does not to the best of my knowledge break any UK law, infringe any third party's copyright or other Intellectual Property Right, or contain any confidential material.

I accept that the College has the right to use plagiarism detection software to check the electronic version of the thesis.

I confirm that this thesis has not been previously submitted for the award of a degree by this or any other university.

The copyright of this thesis rests with the author and no quotation from it or information derived from it may be published without the prior written consent of the author

Signature:

A small, square, slightly blurry image of a handwritten signature in dark ink on a light-colored background. The signature appears to be 'JL Gibbs'.

Date: 3rd December 2015

Abstract

Over the past 20 years, the incorporation of eHealth within health services in England has expanded organically in diverse ways, usually in response to local perceived need, interest or funding. UK government policy and strategies have taken an optimistic view of how eHealth can revolutionise publically funded health care provision and implementation lags far behind expectations. Although there are some excellent examples of how eHealth has been incorporated into NHS practice in a beneficial manner, there is also a concerning lack of evidence to support many of the interventions and new models of service delivery. This largely reflects a disparate and fragmented evidence base within current eHealth literature, particularly in relation to methods for developing online care pathways.

This doctoral research is focused on developing and implementing an online automated clinical care pathway for people with genital chlamydia infection, and developing a robust framework for its evaluation. The care pathway is a core component of an eSexual Health Clinic, also developed as part of this work, which is fully integrated within an NHS specialist sexual health service. An online clinical pathway taking a person from diagnosis of a new condition, through an automated clinical consultation, partner notification and collection of antibiotics from a community pharmacy via an electronic prescription has never been done before in the UK.

The novelty of the work and paucity of literature in this field at times necessitated a different approach from conventional research practice. I started by conducting a scoping review to identify the legal, regulatory, ethical and perceptual barriers to introducing such a pathway into the NHS. Electronic prescribing across the secondary and primary care interface stood out as a barrier to implementation. There was also a clear lack of evidence in terms of the content and accuracy of sexual health mobile medical applications. I went on to conduct detailed reviews of both of these areas.

In the absence of any relevant guidance on developing online clinical care pathways, I then developed my own methods, underpinned by evidence adapted from guidance aimed at traditional clinical care, existing protocols and practice, eHealth and sexual health literature and questionnaires, and created a new eClinical Care Pathway Framework. I then applied this framework to guide my development of the online clinical care pathway for people with genital chlamydia.

We then needed to demonstrate that the Chlamydia online clinical care pathway was feasible, acceptable and safe to take forward into a large scale trial, and potentially implement into clinical practice. There are no accepted methods for evaluation of this type of online clinical care pathway and my final piece of work focussed on developing a set of evaluation techniques and activities, which would assess all these elements to determine whether the online pathway was fit for purpose.

Outputs of this doctoral work include: a comprehensive review of contemporary sexually transmitted infection and sexual health mobile applications (apps); a comprehensive review of electronic prescribing in the UK; a method for developing complex online clinical care pathways based on a novel framework; UK's first automated online clinical care pathway for people with genital chlamydia, and finally a method for evaluation of online clinical care pathways.

Table of contents

Statement of originality.....	1
Abstract.....	2
Acknowledgements.....	6
Thesis outputs.....	7
Introduction.....	11
Chapter 1: Background.....	18
eHealth.....	19
Sexually transmitted infections.....	23
eSexual Health.....	36
eSTI ²	42
Chapter 2: Content and accuracy of currently available mobile medical applications for sexual transmitted and other genital infections: a comprehensive review.....	45
Background.....	45
Definitions.....	47
Aims of this study.....	48
Methods.....	48
Results.....	65
Discussion.....	123
Chapter 3: Review of electronic prescribing in the UK to inform the design of the eSTI ²	
Chlamydia Online Clinical Care Pathway.....	133
Rationale.....	133
Background.....	134
Methods.....	137
Results.....	140
Discussion.....	157
ePrescribing within the eSTI ² Chlamydia trachomatis clinical care pathway.....	159
Chapter 4: Methodology for the development of a remote online clinical care pathway for the management of genital chlamydia.....	164
Introduction.....	164
Methods for developing the remote online clinical care pathway.....	169
Framework for the development of an online clinical care pathway.....	179
Chapter 5: Development of the Chlamydia Online Clinical Care Pathway using the eClinical Care Pathway Framework.....	181
Introduction.....	181
Step 1: Aims of the online clinical care pathway.....	181

Step 2: Defining the functional units and their sequence within the online clinical care pathway.....	182
Step 3: Draft of the online clinical consultation.....	188
Step 4: Expert review.....	264
Step 5: Comprehension testing.....	265
Step 6: User centred interface design.....	267
Step 7: Specification development.....	267
Step 8: Usability testing and further comprehension testing.....	276
Step 9: Piloting of the online clinical care pathway.....	276
Chapter 6: Development of methods to determine whether the eSTI ² Chlamydia Online Clinical Care Pathway is feasible, acceptable and safe, throughout an exploratory clinical study	
Introduction.....	279
Literature review.....	281
Proposed evaluation methods.....	292
Quantitative evaluation tools.....	302
Discussion.....	315
Conclusions.....	321
References.....	326
Appendices.....	355

Acknowledgements

I would like to thank my supervisors, Dr Claudia Estcourt and Professor Richard Ashcroft. I would like to thank Dr Claudia Estcourt for believing in me from the start, inspiring me, always having an open door, helping me to see the 'bigger picture' when I was lost in the undergrowth, and for her patience, kindness and support. I would like to thank Professor Richard Ashcroft for his erudite comments, for helping me see things from a different perspective and for his sage advice.

I would like to thank Sue Eaton, Lorna Sutcliffe, Laura Tickle, Edom Debebe, Catherine Aicken and Dr Jane Hutchinson. It has been an honour to work with you and thank you for being there on so many different levels.

I would like to thank Dr Pam Sonnenberg and Dr Claudia Estcourt for giving me the opportunity to take the work described within this thesis forward.

Finally I would like to thank my family. I could not have done this without you.

Thesis outputs

ARTICLES IN PEER-REVIEWED JOURNALS

Emma M. Harding-Esch, Anthony Nardone, **Jo Gibbs**, Lorna J. Sutcliffe, Pam

Sonnenberg, Claudia S. Estcourt, Gwenda Hughes, Hamish Mohammed, Noel Gill, Syed Tariq

Sadiq, Catherine Lowndes:

Can Remote STI/HIV Testing and eClinical Care be Compatible with Robust Public Health

Surveillance? Digital Health 2015: 129-130 (accepted for publication in ACM)

Voula Gkatzidou, Kate Hone, Lorna Sutcliffe, **Jo Gibbs**, Syed Tariq Sadiq, Ala Szczepura, Pam

Sonnenberg, Claudia Estcourt

User interface design for mobile-based sexual health interventions for young people: design recommendations from a qualitative study on an online Chlamydia clinical care pathway.

BMC Med Inform Decis Mak. 2015 Aug26; 15:72

ORAL PRESENTATIONS AT INTERNATIONAL CONFERENCES

Gibbs J, Sutcliffe L, Ashcroft RE, Sonnenberg P, Sadiq ST, Estcourt C. Development of an Electronic Prescribing System, Linking Specialist Sexual Health Services and Community Pharmacies to Support an Online Clinical Consultation for Remote Management of People with Genital *Chlamydia Trachomatis* within the eSTI² Consortium. Research Oral presentation at the CDC STD Prevention Conference. 9-12 June 2014, Atlanta.

CS Estcourt, **J Gibbs**, LJ Sutcliffe, V Gkatzidou, L Tickle, K Hone, C Aicken, C Lowndes, E Harding-Esch, S Eaton, P Oakeshott, A Szczepura, R Ashcroft, G Hogan, A Nettleship, D Pinson, ST Sadiq, P Sonnenberg. O14.1 Is an automated online clinical care pathway for people with genital chlamydia (Chlamydia-OCCP) within an eSexual Health Clinic feasible and acceptable? Proof of concept study. Research oral presentation at STI & HIV World Congress (ISSTD), Brisbane, Australia, 13-16 September 2015. *Sex Transm Infect* 2015;91:Suppl 2 A55
doi:10.1136/sextrans-2015-052270.153

POSTER PRESENTATIONS AT INTERNATIONAL CONFERENCES

Gkatzidou, V; Hone, K; **Gibbs, J**; Sutcliffe, L; Estcourt, C; Sadiq, ST; Sonnenberg, P; (2013) A user-centred approach to inform the design of a mobile application for STI diagnosis and management. HCI 2013 - 27th International British Computer Society Human Computer Interaction Conference: The Internet of Things

Gibbs J, Sutcliffe LJ, Sadiq ST, Sonnenberg P, Ashcroft RE, Gkatzidou V, Hone K, Estcourt CS. Development of an Automated Online Clinical Consultation with Electronic Antibiotic Prescribing for the Remote Management of Genital *Chlamydia Trachomatis* Infection within the eSTI² Consortium. Research Poster presentation at the CDC STD Prevention Conference. 9-12 June 2014, Atlanta.

CRH Aicken, LJ Sutcliffe, CS Estcourt, **J Gibbs**, LJ Tickle, P Sonnenberg, ST Sadiq, M Shahmanesh. P12.01 Getting your chlamydia care online: qualitative study among users of the chlamydia online clinical care pathway (chlamydia-occp), in a proof of concept study. Research poster presentation at STI & HIV World Congress (ISSTD), Brisbane, Australia, 13-16 September 2015. *Sex Transm Infect* 2015;91:Suppl 2 A185-A186 *doi:10.1136/sextrans-2015-052270.481*

J Gibbs, V Gkatzidou, L Tickle, SR Manning, T Tilakkumar, K Hone, RE Ashcroft, P Sonnenberg, ST Sadiq, CS Estcourt. P12.03 How accurate and comprehensive are currently available mobile medical applications (apps) for sexually transmitted and genital infections: a comprehensive review. Research poster presentation at STI & HIV World Congress (ISSTD), Brisbane, Australia, 13-16 September 2015. *Sex Transm Infect* 2015;91:Suppl 2 A186-A187
doi:10.1136/sextrans-2015-052270.483

J Gibbs, LJ Sutcliffe, V Gkatzidou, P Sonnenberg, K Hone, R Ashcroft, E Harding-Esch, C Lowndes, ST Sadiq, CS Estcourt. P12.02 Developing and using the eclinical care pathway framework: a novel tool for creating online clinical care pathways and its application to management of genital chlamydia. Research poster presentation at STI & HIV World Congress (ISSTD), Brisbane, Australia, 13-16 September 2015. *Sex Transm Infect* 2015;91:Suppl 2 A186
doi:10.1136/sextrans-2015-052270.482

POSTER PRESENTATIONS AT NATIONAL CONFERENCES

Aicken CRH, Estcourt CS, **Gibbs J**, Sonnenberg P, Mercer CH, Tickle L, Sutcliffe LJ, Sadiq ST, Shahmanesh M. Online clinical management pathways for chlamydia treatment: enriching formative evaluation of a complex e-health intervention. UCL Qualitative Health Research Symposium. 18 February 2015, University College London.

Emma Harding-Esch; Anthony Nardone; **Jo Gibbs**; Lorna Sutcliffe; Pam Sonnenberg; Claudia Estcourt; Gwenda Hughes; Hamish Mohammed; Noel Gill; S Tariq Sadiq; Catherine Lowndes

Both novel diagnostic testing platforms and established data capture systems must be adaptable to ensure robust public health surveillance. 5 Nations Health Protection Conference, 18-20th May, 2015

PROPOSED FIRST AUTHOR PUBLICATIONS

Content and accuracy of STI mobile medical applications: a comprehensive review

Electronic prescribing in the UK: time to fill the gap between primary and secondary care

The feasibility, acceptability and safety of an online clinical care pathway for the remote management of genital *Chlamydia trachomatis*

The *eClinical Care Pathway Framework*: a novel framework for creation of online complex clinical care pathways and its application in management of bacterial sexually transmitted infections (STIs)

Introduction

Sexually transmitted infections (STIs) continue to be an important public health issue in England although the increasingly austere financial environment and National Health Service structural reforms appear to be threatening existing service provision. Currently people are able to access STI and sexual health care in state-provided healthcare settings via a number of different routes including specialist Genitourinary Medicine clinics and sexual health clinics (the two names are used synonymously), family planning clinics, general practice, pharmacies, and people age 15-24 can use the National Chlamydia Screening Programme. Developments in diagnostics mean that it is now possible for people to self-sample for many of the commonly diagnosed infections including chlamydia, gonorrhoea, HIV, syphilis and hepatitis B, within a healthcare setting, in non-clinical venues, or in their own homes. Rapid advances in digital technology has led to a transformation in the way that services are provided and in the way that information is collected, stored, transmitted and communicated. The combination of these factors means that it is now possible for people to self-sample or even self-test (for some infections), receive a diagnosis and receive care remotely without contact with a health care professional.

This doctoral research is rooted in online sexual health and was undertaken as part of the eSTI² [Electronic Self-Testing Instruments for Sexually Transmitted Infections] Consortium(4). The Consortium is a collaboration of academic, NHS and industry partners which includes Queen Mary, University of London. It aims to *'reduce the high impact of sexual transmitted infections (STIs), a national priority for UK health, by building translation capacity to develop, improve, evaluate and implement simple to use, rapid, accurate, polymicrobial and affordable point of care and non- point of care micro-diagnostics that can be mobile-phone networked'*(4). I will discuss this in more detail in Chapters 1 and 3.

THE KEY AIMS OF THIS DOCTORAL RESEARCH ARE:

To develop, and evaluate a novel internet-based clinical care pathway for the management of genital *Chlamydia trachomatis* to enable patients to be managed remotely in a safe and timely manner, within the legal and regulatory constraints of the NHS in England.

RESEARCH QUESTIONS

My principal research questions were:

1. What is the accuracy and content of mobile medical apps for sexually transmitted and genital infections
2. What is possible and what are the constraints with electronic prescribing across the secondary and primary care interface within the NHS?
3. How can we design a clinical care pathway for the remote management of patients testing for *Chlamydia trachomatis* which includes a results service, automated online clinical consultation, partner notification and electronic prescribing
4. How can we best evaluate online clinical care pathways for genital chlamydia

SPECIFIC OBJECTIVES

1. To conduct a comprehensive review of currently available mobile medical applications for sexually transmitted and other genital infections
2. To undertake a comprehensive review of ePrescribing in the UK
3. To develop the methodology to design an online clinical care pathway for management of sexually transmitted genital *Chlamydia trachomatis*

4. To develop an online clinical care pathway for management of sexually transmitted genital *Chlamydia trachomatis*
5. To evaluate the eSTI² chlamydia online clinical care pathway

RESEARCH STUDIES UNDERTAKEN TO ADDRESS RESEARCH QUESTIONS AND MEET SPECIFIC OBJECTIVES

1. A systematic review of STI and genital infection mobile medical apps
2. A comprehensive review of ePrescribing in the UK
3. Development of the eClinical Care Pathway Framework as a method for designing an online care pathway
4. Application of the eClinical Care Pathway Framework to design the Chlamydia Online Clinical Care Pathway
5. Development of methods to evaluate the feasibility, acceptability and safety of the Chlamydia Online Clinical Care Pathway

OVERALL APPROACH

eHealth is a very broad field with a large body of literature which is rapidly evolving, disparate, poorly collated, and of variable quality(5). In order to provide workable boundaries for my studies, I have concentrated on online eHealth, whilst expanding to other elements of eHealth where relevant, and focussing on specialist Sexual Health Services in a National Health Service (NHS) context.

I initially conducted a literature review of the legal, ethical, regulatory and perceptual barriers to introducing a novel clinical care pathway into the NHS, with a focus on the issues related to the introduction of an online clinical consultation for *Chlamydia trachomatis*. This topic was not conducive to a systematic review due to its breadth and complexity and lack of

randomised controlled trials or other empirical studies. I developed my own framework for analysing and applying the different barriers found in different elements of the care pathway. I identified gaps and issues with the current knowledge base and legislation and regulations. The outputs from this were used directly to inform feasibility of our intended approach within the research consortium. After much consideration, I have chosen not to include this as a separate body of work in my thesis as it did not fit with the flow of this work, however its outputs have clearly informed development of the pathway.

My doctoral work has been coupled to tight research consortium deliverables. This meant that, with the agreement of my supervisors, I have had to focus on specific outputs, such as the development of the online clinical consultation, ahead of developing the publications which will stem from them. I have therefore listed conference presentations and proposed first author publications on page 9. Due to close collaboration with other members of the eSTI² consortium and the multi-disciplinary nature of this research, I have clearly stated at relevant points in the text where the work described has been conducted by myself, where it has been conducted in conjunction with other members of the team, and where another researcher has undertaken the work.

I provide an overview of the content of my chapters below. Two studies (the medical mobile app review and ePrescribing review) lend themselves to a traditional research write up framework. However, the iterative and interdependent nature of my work on methodology, development and evaluation of the online clinical pathway did not lend itself to “best practice” write up structures and attempts to shoehorn the work into a classical style resulted in a lack of clarity and duplication across chapters. I have therefore chosen a different approach as I believe this is the clearest method of describing the research. However, due to the iterative and continuous evaluative nature of the evolution of the online clinical care pathway, there is some unavoidable cross-referencing between these three chapters. Due to the

interdependency of these chapters, I have combined the discussion for all three chapters at the end of Chapter 6.

CHAPTER 1: BACKGROUND

I start by providing a background to eHealth before focussing on sexual health and then eSexual Health. I provide a background to the eSTI² consortium (within which my PhD is funded) and the Chlamydia Online Clinical Care Pathway exploratory study.

CHAPTER 2: CONTENT AND ACCURACY OF CURRENTLY AVAILABLE MOBILE MEDICAL APPLICATIONS FOR SEXUALLY TRANSMITTED AND OTHER GENITAL INFECTIONS: A COMPREHENSIVE REVIEW

In this chapter I review the content and accuracy of mobile medical apps for sexually transmitted and other genital infections. The main findings were that the content and accuracy of currently available mobile medical apps for sexually transmitted and other genital infections are highly variable, with no way for a member of the public to determine the reliability of the information provided. A process for accreditation could be useful but may be unfeasible within short timeframes.

CHAPTER 3: REVIEW OF ELECTRONIC PRESCRIBING IN THE UK TO INFORM THE DESIGN OF THE CHLAMYDIA ONLINE CLINICAL CARE PATHWAY

Here I review electronic prescribing in primary and secondary care in the UK from a legal, regulatory and structural perspective. I also formulate and discuss the options for electronic prescribing within the Chlamydia Online Clinical Care Pathway. Although I developed a workable process for the exploratory study within the eSTI² consortium, significant barriers exist for wider implementation.

CHAPTER 4: METHODOLOGY FOR THE DEVELOPMENT OF A REMOTE ONLINE CLINICAL CARE PATHWAY FOR THE MANAGEMENT OF GENITAL CHLAMYDIA

In this chapter I describe the limited existing evidence base for informing online clinical care pathway development for the management of genital chlamydia before describing the process of developing a robust methodology for developing the eClinical Care Pathway Framework. As previously discussed, I discuss the findings from Chapters 4, 5 and 6 together at the end of Chapter 6.

CHAPTER 5: DEVELOPMENT OF THE CHLAMYDIA ONLINE CLINICAL CARE PATHWAY USING THE eCLINICAL CARE PATHWAY FRAMEWORK

Here I describe how I used the eClinical Care Pathway Framework, described in chapter 4, to develop the chlamydia online clinical care pathway.

CHAPTER 6: DEVELOPMENT OF METHODS TO DETERMINE WHETHER THE eSTI2 CHLAMYDIA ONLINE CLINICAL CARE PATHWAY IS FEASIBLE, ACCEPTABLE AND SAFE, THROUGHOUT AN EXPLORATORY CLINICAL STUDY

In this chapter I discuss evaluation of eHealth interventions and describe how I used available evidence to guide my methods to determine the feasibility, acceptability and safety of the eSTI² Chlamydia Online Clinical Care Pathway. I conclude with a discussion covering Chapters 4, 5 and 6.

CHAPTER 7: CONCLUSIONS

Finally I draw together my findings from this body of work in a section on conclusions and recommendations.

Chapter 1: Background

Here I set the scene for my doctoral research. As eHealth and eSexual Health encompass a very diverse body of work and literature, by necessity I focus on the literature background relevant to the original work presented within this thesis.

Mobile and electronic information and communication technology (ICT) play an important role in most people's everyday life in the UK. Between 2004 and 2014, the proportion of households with broadband access rose from 16% to 77% (6). It is possible to search for and find information or advice on anything that comes to mind within a matter of seconds using internet-enabled devices. For many people communicating via short message service (SMS), email and social media has become the norm. Mobile phones are ubiquitous within the UK with 61% of adults owning a smartphone (6). Boulos et al estimate that within 10 years 80-90% of the UK population will have a smartphone(7). Likewise, there is a digital divide in terms of smartphone ownership depending on age and socio-economic group with highest rates of ownership in 16-24 year olds (88%) and those living in socio-economic group ABC1 (69% ownership compared to 51% in group C2DE)(6).

Fifty seven percent of people access the internet via their mobile phone(6). The most popular internet-enabled devices are laptops, with 63% of households possessing one(6). Young people are particularly adept at using digital technology, with a higher proportion of men having a high level of confidence using ICT compared to women (6). People in ABC1 socio-economic group (traditionally defined as lower middle class to upper middle class (8)) have a higher level of confidence with digital technology, than those in C2DE(6).

It is natural, therefore, that this ease and convenience of communication should be applied to publically funded health care (National Health Service (NHS)) in the form of eHealth. eHealth

has the potential to increase patient choice and control of one's own health, which is very much in keeping with the current political climate(9;10). In addition, it is thought that it will lead to increased efficiency and efficacy, although this has yet to be sufficiently demonstrated in practice.

I will start by giving an overview of eHealth and Sexual Health before focussing in on eSexual Health.

1.1 eHEALTH

1.1 WHAT IS eHEALTH?

eHealth is the utilisation of evolving information and communication technology to develop and improve the organisation and delivery of health services and healthcare(11;12). Eysenbach expands this definition to include 'a new way of working, an attitude, and a commitment for networked, global thinking, to improve health care locally, regionally and worldwide by using information and communication technology'(12).

1.2 THE CURRENT STATE OF eHEALTH IN THE NHS

eHealth has developed organically in the UK over the past 20 years and is increasingly incorporated into everyday practice both from the clinician and patient perspective. Driven by advances in technology, perceived increased efficiency and cost-effectiveness, and latterly policy (discussed below) notable examples of its adoption include telephone consultations, telemedicine for e.g. dermatology consultations(13), computer-based access to laboratory results and medical imaging, adoption of email between physicians and other healthcare professionals as an acceptable form of communication and latterly physician and patient, introduction of electronic health records (EHR), electronic prescribing, short message service (SMS) reminders for appointments and test results, and the use of personal digital assistants predominately for physician-assisted clinical care.

Particularly relevant to my work is the use of eHealth tools for history taking in primary care, outpatient clinics and acute settings. Over time this has moved away from being guided by a clinician's own technique towards the use of standardised data collection tools. Medical history proformas have gained popularity as a means of improving the quality and relevance of data collected in these settings (14-17). These were initially in a paper format and formed part of a patient's paper record. In the last 10 years there has been an increasing move towards the use of EHRs, with the history being inputted by a clinician or, in some cases, by the patient.

There is great variation in how the term 'Electronic Health Records' has been interpreted and applied (5;18). In the context of this paper, EHR is being used to describe the collated data that is being collected from the registration of an individual prior to, or when, conducting a POC test, the result of that test, and if that test is positive, the information gathered during the online clinical consultation.

A key question is whether an electronic questionnaire can replace a clinician and be used to inform a decision tool to decide patient outcome (i.e. to treat or to refer to HCP input).

Whilst taking a history from a patient a clinician digests the information and uses it to decide:

1. what, if any, examination is required;
2. which investigations are required;
3. what is the differential diagnosis;
4. the best way to manage the patient

A wide array of clinical decision support tools or systems (Clinical Decision Support Systems) have been introduced, initially in a research setting, into clinical practice in recent years to aid or in part replace physicians in this decision making process(19-38).

Most of the literature relating to decision support is in the context of practitioners using the software, as opposed to the case of patients using the tool outside a medical setting, without clinician input. In addition, there is only weak evidence that Clinical Decision Support Systems improve clinician performance, or that even where behaviour change occurred, that there was an improvement in quality of care (20;39).

Richens et al demonstrated that the utilisation of a computer interview, irrespective of whether it was a HCP or patient inputting the data, led to greater disclosure of sensitive information. They concluded that it was the rigid structure of the computer interview, with the mandatory answering of what may be perceived as embarrassing questions, which led to this as opposed to a reduction in social desirability bias which had been postulated from earlier studies (40). Munger et al have shown non-inferiority when comparing an electronic medical interview tool and a traditional medical consultation for prescribing erectile dysfunction drugs. They found that the electronic tool was superior to traditional methods for medication counselling, and that standard diagnostic questions that were asked by the electronic medical interview were rarely asked in the traditional consultation (41).

The way results of investigations are communicated is an important aspect of medical care. With growing pressure on healthcare resources and advances in technology the use of electronic means of communicating with patients is increasingly being used.

In terms of literature, a Cochrane review on mobile phone messaging for communicating results of medical investigations published in 2012 found only one low quality study that fitted their selection criteria(42). A Cochrane review on email for communicating results of medical investigations published in 2012 failed to find any studies that met its selection criteria(43). It is clear that good quality studies need to be conducted which evaluate the use of both mobile phone and email use in clinical practice.

Concerns with the use of mobile phones as communication tools in healthcare include possible breaches of privacy and confidentiality if the phone is borrowed, lost or stolen(44). In addition, if the only contact details for an individual is a mobile phone number, and the phone is lost, then it is then no longer possible to contact that patient. There is also the issue of the exclusion of populations who are unable to afford or access information and communication technology. Clinicians are encouraged to use the NHS.net email service if communicating to or about patients, because of its higher security standards compared to other email services.

Clinicians are also advised to print any email communication sent or received from patients and file it in their health records(45). Car et al have made clear suggestions for minimising the legal risks of using email in practice(5). When implementing an email service within NHS hospitals it is necessary to get permission from the Trust NHS Information Governance board. This can be where the largest barrier to implementation lies, with, for example, at least one NHS London Teaching Hospital being prohibitively averse to the use of email communication with patients in clinical practice (46).

In recent years the internet has also been the focus of eHealth initiatives, harnessing more sophisticated forms of eHealth such as internet-based information and interventions, smartphone apps and healthcare professional use of social networking, for example for partner notification (PN). My doctoral work is rooted within internet forms of eHealth, incorporating other elements of eHealth as they interdigitate with online care.

To date the majority of user / patient targeted eHealth innovations have centred on monitoring of a diagnosed chronic condition and promoting self-care e.g. asthma, diabetes, medication adherence e.g. HIV, behavioural interventions e.g. smoking cessation.

(23;33;47;47-63). They are largely internet-based web applications, smartphone apps, or SMS-based, and the majority are intended to be used in partnership with the health care provider e.g. hospital service as an adjunct to routine “traditional” care. There have been several reviews of mobile phone apps available for patients living with HIV (64;65), asthma (66;67), diabetes (68;69), and people trying to give up smoking (70;71). Concerns have been raised over the lack of regulation of the content and accuracy of existing medical mobile phone apps (72-77) I discuss this in further detail in Chapter two. Only a small portion of eHealth has been directed to both diagnosis of a new condition and remote management. Clinician-targeted mobile apps generally aim to aid health care professionals in their management of patients (78-82).

Policy for eHealth first appeared in 1998(83). The Department of Health's aspiration was for a patient-centred, patient-accessible, integrated provision of care, with flow of information and interoperability, whilst maintaining adequate confidentiality. Great emphasis was being put on the introduction and utilisation of eHealth technologies (84-88). This ethos has been continued by NHS England(9;89;90). However, there is a disparity between the Department of Health's ideals, NHS England's policy and current practice. This is discussed in further detail in Chapter 3.

In the current NHS environment of efficiency, stream-lining and financial austerity, a major driver for the introduction of eHealth has been its perceived cost-effectiveness compared to traditional services. Costs and economic evaluation are included in the outcomes considered in the assessment of new healthcare technology(91). However, economic evaluation of eHealth initiatives has been largely untested with implementation occurring with minimal evaluation(92). Health economists are performing a cost-consequence analysis of the Chlamydia-OCCP as part of eSTI² work stream 4.

2 SEXUALLY TRANSMITTED INFECTIONS

2.1 WHAT ARE SEXUALLY TRANSMITTED INFECTIONS?

Sexually transmitted infections (STIs) are bacteria, viruses and protozoa that are transmitted between individuals during sexual intercourse. This usually involves contact with one individual's genitalia and another individual's genitalia, anus/rectum or oropharynx. However some STIs, for example HIV and syphilis, can be transmitted via contact with blood or skin lesions respectively.

2.2 OVERVIEW OF EPIDEMIOLOGY OF STIs

Rate of transmission of STIs is dependent on three factors: 1. Duration of infectivity; 2.

Infectiousness of the organism; 3. Number of people who are susceptible to the infection that the index patient comes into contact with(93). This is represented by the following equation:

$$\text{Basic reproductive rate (Ro)} = C \times P \times D$$

Where C is the number of people the index patient makes contact with per unit time, P is the probability of transmission when contact takes place, and D is the time that the index patient remains infectious to others. When Ro is greater than 1 then transmission of an infection is sustainable within a population(93). In terms of public health interventions, only C and D can be manipulated to reduce Ro.

STIs are common, with more than one million new infections every day worldwide(94). The most prevalent treatable STIs are chlamydia, gonorrhoea, trichomonas and syphilis; the most prevalent incurable STIs are genital herpes, human papillomavirus, hepatitis B and HIV(94). The majority of sexually transmitted infections are asymptomatic and therefore go undiagnosed and untreated. They are a major cause of morbidity with approximately 500 million people per year suffering adverse effects secondary to infection with chlamydia, gonorrhoea, syphilis and trichomonas. As well as causing clinical symptoms and complications to the infected person, some STIs can cause adverse outcomes in pregnancy, disease in neonates and increase the risk of HIV transmission by three-fold or more(94).

England:

England has a robust public health surveillance programme led by Public Health England. Data from genitourinary clinics on new diagnoses of STIs, along with service provision, is collected on a quarterly basis from all Level 3 (specialist) and commissioned Level 2 (intermediate)

sexual health services(95). The Genitourinary Medicine Clinic Activity Dataset (GUMCADv2) is pseudo-anonymised and consists of basic demographics, attendance information, clinical details and coding of service provided, diagnoses made and management(95). Since 2012, primary care and community services have been required to complete the Chlamydia Testing Activity Dataset(96) .

In 2013 there was a small decline in the overall incidence of STIs when compared to 2012, with 446,253 new diagnoses made in England. For the preceding 10 years there had been a steady increase in overall new diagnoses of STIs. The advent of new tests using polymerase chain reaction to detect certain infections, with increased accuracy of tests and introduction of self-sampling, is likely to have contributed to this increase(97). In addition, in 2012 there was a change in Public Health England surveillance methods and, for the first time, community genital chlamydia diagnoses for adults aged over 24 were incorporated in the 2012 figures(98). Despite this, the consensus is that current methods are not adequately controlling STIs in the UK and that there is a need for greater access for all age groups (97;99).

Although there has been an overall decrease in incidence of STIs, there continues to be a significant increase in the incidence of certain STIs, for example gonorrhoea, particularly in men who have sex with men and some ethnicities (e.g. black ethnicity)(97). Young people aged 16-24 have disproportionately higher incidences of STIs compared to other age groups. The commonest bacterial STI in England is *Chlamydia trachomatis* and there was a small increase in diagnoses of this infection between 2012 (207,795) and 2013 (208,755). 58% of chlamydia diagnoses in 2013 were made in women. In 2013, 101,179 people were diagnosed with chlamydia in GUM clinics whilst 107,576 were diagnosed in the community. A higher proportion of women were diagnosed in the community (60.1%), whereas a greater proportion of men were diagnosed in GUM clinics (61.4%)(100).

For the purposes of my doctoral work (and the eSTI² exploratory trials, Chapters 3 to 5) we focus on *Chlamydia trachomatis* as it is common, easy to diagnose, and the first-line treatment

is with a single dose of oral azithromycin 1g. This, along with advances in diagnostic tests, self-sampling, and information communication technology, means that *Chlamydia trachomatis* is amenable to various internet based eHealth interventions including remote (outside traditional healthcare services with no direct contact with a healthcare professional) management.

2.3 CHLAMYDIA TRACHOMATIS

Chlamydia trachomatis is an obligate intracellular bacteria belonging to the genus Chlamydia. It cannot be cultured on artificial media, and is diagnosed using nucleic acid amplification tests (93). The major outer membrane protein gene is used to type *Chlamydia trachomatis* strains (93). I have summarised the different strains of *Chlamydia trachomatis*, and the diseases they cause, in Table 1 below:

I will focus on serovars B to K and use the term genital chlamydia to describe this.

Genital chlamydia infects squamocolumnar-columnar epithelium, with sites of infection including the urethra, cervix, fallopian tubes, epididymis, rectum, pharynx, conjunctiva and liver capsule. Clinical sequelae of infection include urethritis, cervicitis, salpingitis, epididymitis, proctitis, conjunctivitis, sexually acquired reactive arthritis and Fitz-Hugh-Curtis Syndrome(93).

Genital chlamydia is the commonest bacterial sexually transmitted infection diagnosed and managed in the United Kingdom(98), North America and Europe(93). The main burden of infection is seen in young adults (15-24 years of age), with 63% of diagnoses of genital chlamydia in heterosexuals being in this age group in 2013(97) . One of the major challenges in detecting and diagnosing *Chlamydia trachomatis* is that a substantial proportion of infections are asymptomatic(93).

Table 1: The different strains of *Chlamydia trachomatis*, adapted from Holmes et al(93) p559

Species	Biovar	Serovar	Disease
<i>C.trachomatis</i>	Lymphogranuloma venereum	L1, L2 and L3	Lymphogranuloma venereum
<i>C.trachomatis</i>	Trachoma	A, B, Ba, C	Trachoma
<i>C.trachomatis</i>	Trachoma	B, D, E, F, G, H, I, J, K	Neonates: inclusion conjunctivitis and pneumonia Adults: asymptomatic infection, urethritis, cervicitis, epididymitis, salpingitis, proctitis, sexually acquired reactive arthritis, Fitz-Hugh-Curtis Syndrome

The high rates of infection, asymptomatic nature of the infection, and the complications and morbidity associated with infection led to the introduction of the National Chlamydia Screening Programme (NCSP) for women in the UK in 2003(101). The NCSP is described in further detail on page 32.

2.4 SEXUAL HEALTH?

Worldwide

Sexual health is defined by the World Health Organization as: "...a state of physical, emotional, mental and social well-being in relation to sexuality; it is not merely the absence of disease, dysfunction or infirmity. Sexual health requires a positive and respectful approach to sexuality and sexual relationships, as well as the possibility of having pleasurable and safe sexual

experiences, free of coercion, discrimination and violence. For sexual health to be attained and maintained, the sexual rights of all persons must be respected, protected and fulfilled.”(102). It is recognised that human sexual behaviour is complex and that “these factors affect whether the expression of sexuality leads to sexual health and well-being or to sexual behaviours that put people at risk or make vulnerable to sexual and reproductive ill-health.”(102)

Britain

The importance of including sexual behaviour, experiences and relationships, as well sexual health outcomes, in the scope of sexual health was reiterated by Wellings and Johnson in their Comment published in the Lancet accompanying the publication of the results of the third British National Survey of Sexual Attitudes and Lifestyles (Natsal-3)(103). Major findings from the recent Natsal-3 publications included the persistence of high rates of STIs despite an increase in the proportion of the population testing for STIs and accessing Sexual Health services, with 3.1% of women, and 2.3% of men aged 16 to 24 years of age testing positive for *Chlamydia trachomatis* (104). Nine point eight percent of women and 1.4% of men reported non-consensual sex, with a median age at the most recent incident of 18 years for women and 16 years for men. A variety of adverse health outcomes were found to be associated with non-consensual sex (105). In addition, poor health was found to have an adverse effect on sexual activity and sexual satisfaction, irrespective of age(106). Other findings included multiple factors being associated with low sexual function including a strong association with current depression, poor self-assessed general health, non-consensual sex and having had a STI diagnosed within the past five years. 41.6% of men and 51.2% of women reported at least one sexual function problem lasting three months or more in the past year (107). Compared to Natsal-2, women reported having more male sexual partners over their lifetime, the proportion of women reporting genital contact with a female and at least one female sexual partner increased, and there was a decrease in the number of occasions heterosexual participants reported having sexual intercourse in the preceding four weeks. There was an increase in the proportion of heterosexual participants reporting oral and anal sex. Although

there is a reduction in frequency and repertoire, people continue to have sexual intercourse into later life (108).

2.5 SEXUAL HEALTH SERVICES IN ENGLAND

Development of contemporary sexual health provision in England

The National Strategy for sexual health and HIV, “a comprehensive framework for England for preventing the sexual causes of premature death and ill health”, was published in July 2001(109). This was produced in response to concerns about the state and capacity of Genito-Urinary Medicine (GUM) services within England. Over the preceding decade there had been a marked increase in number of new attendees at GUM clinics and new diagnoses of chlamydia and gonorrhoea. Outbreaks of syphilis were reported in London, Brighton and Manchester (110;110-112). GUM clinics lacked the resources to adapt to this increase in demand (113;114). In 2000 only 54% of clinics were able to provide access within 24 hours for acute cases. There was a median waiting time of 5 and 6 days (range 1-28 days), for men and women respectively (115). Kinghorn described “unacceptable geographical inequities in the levels of sexual ill health and service provision”(116). The National Strategy was followed by an Implementation Action Plan that was published in 2002(117). The specific aims of the strategy were: *“1.Reducing the transmission of HIV and STIs; 2. Reducing the prevalence of undiagnosed HIV and STIs; 3. Reducing unintended pregnancy rates; 4. Improving health and social care for people living with HIV; 5. Reducing the stigma associated with HIV and STIs”*(109)

The main recommendations of the strategy were divided in to four sections: prevention; standards and targets; services; research and training(109;116). Some of the major changes and implementations that came about following the introduction of this strategy were:

1. National standards for sexual health services
2. National standards for the management of STIs

3. Development of care pathways and clinical networks
4. Increased role of primary care with the introduction of three levels of service (Level 1 (basic), Level 2 (intermediate) and Level 3 (specialist))
5. Improved access to GUM services
6. National Chlamydia Screening Programme

In 2003 the House of Commons Health Select Committee called for action in resolving what they described as a crisis in sexual health in England. The committee found that primary care trusts (PCTs) were failing to engage with the aims and objectives set out in the National Strategy for sexual health and HIV (118). Following this report, the Department of Health announced that they were investing more money in sexual health (119).

In 2006 the Chief Medical Officer, Sir Liam Donaldson, sent out a letter, flagged urgent, to all chief executives of primary care trusts and strategic health authorities in England, entitled 'Improving the Prevention and Treatment of Sexually Transmitted Infections (STIs), including HIV'(120). Within this letter Sir Donaldson draws chief executives attention to the National Standards for sexual health (in 2005)(121) and HIV (in 2003)(122) that had been published by MedFASH, as well as discussing *'The NHS in England: the operating framework for 2006/7'*(120;123). Sexual health and access to GUM services were prioritised in this framework, and targets for access were introduced; by 2008 all patients were to be offered an appointment within 48 hours. Despite this, sexual health services in England remain in a state of flux. There have been marked improvements, with patients having shorter waiting times, and a more direct route, to access GUM care in 2009 compared to 2004/5(124).

Recent changes in sexual health commissioning

Following on from a wide ranging reform of the delivery of the NHS across UK (health and social care act) , in March 2013 'A Framework for Sexual Health Improvement in England'(125) was published, superseding the National Strategy for Sexual Health and HIV. Key objectives of

this document include: *“Improve the sexual health of the whole population; Reduce inequalities and improve sexual health outcomes; Build knowledge and resilience among young people; Rapid access to high quality services; People remain healthy as they age; Prioritise prevention; Reduce rates of STIs among people of all ages; Reduce onward transmission of HIV and avoidable deaths from it; Reduce unintended pregnancies among all women of fertile age; Continue to reduce the rate of under 16 and under 18 conceptions”* (125).

The framework calls for *“collaboration and integration between a broad range of organisations, including commissioning organisations, in order to achieve desired outcomes”*(125).

These reforms have brought unprecedented change to commissioning arrangements. Since April 2013, comprehensive sexual health services have been within the remit of Public Health England and therefore Local Authorities are responsible for commissioning these services. Certain aspects of sexual health, including HIV care, are commissioned by NHS England(125). The ‘shop-front’ provision of sexual health is provided by a number of different healthcare providers including tertiary genitourinary clinics, sexual and reproductive health clinics, general practice, family planning clinics, and the NCSP. This increase in provision of screening, particularly for *Chlamydia trachomatis*, out with traditional specialist GUM services was advocated over 20 years ago (126), and has been increasingly promoted as a solution to problems with sexual health service provision by the Department of Health(109;125).

A greater proportion of the diagnoses of *Chlamydia trachomatis* in female patients are now made in the community, whilst men continue to be more commonly diagnosed within GUM clinics. However, access to testing, quality and cost of care, both to the patient and Local Authorities, continues to differ depending on the geographical location where the patient abides (127-129). In addition, collaborative integrated services, combining contraception and sexual health, are in vogue, although there is a lack of guidance on what constitutes an integrated service, which services should be integrated and evidence supporting this approach

(130). There has been a move towards shifting tertiary services into the community, with some areas being put out to tender. It is my opinion that there continues to be unacceptable inequality in care depending on where one accesses a service, duplication or replication occurs with people still needing to be seen, or needing to access, two or three different services in order to be managed in full, and there remains a lack of communication between individual services provided in one area.

England's National Chlamydia Screening Programme (NCSP)

In 1998 the Chief Medical Officer published the findings of an Expert Advisory Group on *Chlamydia trachomatis*. The main conclusions of this report included the need to reduce the prevalence, and thereby the morbidity, of infection with *Chlamydia trachomatis*, and the need for innovative methods of testing, which should be coordinate with existing methods in a national screening programme(131). In 1999, two pilot chlamydia screening programmes were conducted in 16-24 year olds living in the Wirral and Portsmouth. Services that participated in recruiting young people for the trials included general practices, family planning clinics, GUM clinics, gynaecology services, antenatal clinics and colposcopy clinics. Women were primarily targeted, along with men who were offered testing in specific settings(132). The pilot screening programmes were found to be both feasible and acceptable methods of implementing screening programmes in the population tested. The pilot studies proved a good illustration of where targeted standard screening involving all services that provide sexual health screening can be effective.

The English NCSP was rolled out by the Department of Health in 2003. It aimed 'to ensure that all sexually active young people under 25 are aware of chlamydia, its effects, and have access to free and confidential testing services'(101). General practices, GUM clinics, and gynaecological services were excluded from this programme.

The scientific rationale for the implementation of the NCSP has since been criticised. Adams et al, in their evaluation of the cost effectiveness of opportunistic chlamydia screening published

in 2007, conclude that a less inclusive screening programme is likely to be more cost-effective than the current NCSP (133). Another concern with an opportunistic national screening programme is that we will not reach a high enough proportion of the population to influence transmission, and prevent complications(134).

In 2008, Dr Ruth Hussey, the North West Regional Director of Public Health, was requested to review the effect and achievements of the NCSP. Welcome findings of this review included an improvement the proportion of 16-24 years old accessing chlamydia screening and improved insight into the actions required to continue successful opportunistic screening in this population. Concerns included the multiple points of access for requesting postal testing via the internet, with a national standard internet access felt to be preferable, and the array of messages being projected from different chlamydia screening offices. Furthermore, variable costs for sexual health services, 'even within the same region', were raised (135;136).

Although in 2011 91.6% of patients diagnosed positive for chlamydia via the NCSP had treatment outcomes recorded, there was great variability in terms of both Strategic Health Authority and individual Primary Care Trusts. For example, London had a treatment outcome of 83.9% whilst Yorkshire and Humber achieved 91.6%. The Primary Care Trust with the lowest treatment outcome was Shropshire County with an index treatment rate of 56.2%(137).

In recent years, the NCSP has recommended that 16-24 year olds test annually for chlamydia and certain providers offer dual screening for *Neisseria gonorrhoea*, despite low national levels of gonorrhoea and the low positive predictive value of NAAT testing for this organism in most community settings.

Our interactions with the NCSP within London have indicated that each former Primary Care Trust, and current local authority, have their own NCSP office. Each office is allowed to implement the programme in a manner that they feel best. Some offices have collaborated and use a shared website to promote screening, and the same laboratory for testing and delivery of results, whilst other chlamydia screening offices have chosen to work

independently. At present there does not seem to be a clear method for highlighting those chlamydia screening offices that are most successful, and could therefore be held as an example of best practice, and those that are failing, and therefore need input, as the data collected for the Chlamydia Testing Activity Dataset is regional. The Chlamydia Testing Activity Dataset was introduced in 2012, replacing the NCSP core data return, as a way of collating NCSP and community (non-GUM, non-NCSP) data by Public Health England(96).

2.6 DIFFERENCES BETWEEN SEXUAL HEALTH AND OTHER OUTPATIENT SERVICES WITHIN THE NHS

Open access

GUM clinics have traditionally worked on an open access basis, with patients being able to self-refer to the clinic without going through their GP. This process dates back to the Venereal Disease Act in 1916 (see below), when the government was attempting to deal with increasing numbers of new diagnoses of sexually transmitted infections in the Armed Forces during the First World War. The 1916 Public Health Venereal Disease Regulations stated that services needed to be available and accessible for confidential STI testing and treatment should be free at the point of access (138).

The majority of patients accessing GUM services today continue to access the clinic via self-referral or via other routes that bypass GPs. Patients are asked which method for communication of results or other necessary contact is acceptable, and in some cases preferable, to them and whether the clinic has permission to contact their GP. Currently patients are able to access any GUM clinic they wish to visit and are not restricted to the local authority within which they live. With the new commissioning changes implemented in April 2014, clinicians may be scrutinised by commissioners as to the resident versus non-resident population they are serving.

Confidentiality

The sensitive nature of the information collected within a sexual health consultation, led to the introduction of the 1916 Venereal Disease Regulations(138). This regulation ensured that people accessing GUM services could remain anonymous and would be able to access treatment free of charge. The importance of confidentiality in this setting was reiterated in the NHS Trusts and Primary Care Trusts (Sexually Transmitted Diseases) Directions 2000 (139). It remains standard practice for hospital-based GUM clinics to have a separate set of clinic notes (electronic or paper) for patients from their other hospital notes. However, the NHS Trusts and Primary Care Trusts (Sexually Transmitted Diseases) Directions 2000 does not apply to Foundation Trusts nor private STI health providers. It is unclear what the implications of this will be in terms of how confidentiality is handled and the use of national NHS identification numbers in the future.

Stigma

Sexual Health differs from other areas of medicine because of the stigma attached to many of the conditions it deals with and, because of this, the requirement of heightened confidentiality as I will discuss in later sections of my thesis.

Population

GUM is one of the few specialities where the majority of its users are young, healthy and mobile, and whose expectations and needs are likely to differ from an older, more stable population with existing comorbidities.

3 eSEXUAL HEALTH

3.1 ADOPTION OF eHEALTH BY SEXUAL HEALTH

“eSexual Health” does not currently exist as a MESH terms and there is no official definition of the term. Therefore, I will broadly define it as **the use of digital technology within sexual health.**

GUM and Sexual and Reproductive Health clinics have reflected and, in some cases, led the emerging field of eHealth. Paper-based history proformas were rapidly adopted, partly because the standard set of questions required in any sexual health consultation lending itself naturally to this format, but also because of the role of multiple health care professionals in the speciality. For example, specialist and qualified staff nurses, and in some cases, technicians, see asymptomatic or minimally symptomatic patients, and junior doctors rotating into Sexual Health often have a limited knowledge of the speciality. The adaption of paper proformas into electronic format has been driven by the need for a computerised database containing patient information for audit requirements, with the speciality having a well-organised national and regional audit network (140), and for vital Public Health England surveillance purposes(141). In certain clinics, asymptomatic patients are able to input their own details and history using computer assisted self-interviews, then take their own swabs, and finally have their bloods taken by a nurse or health care assistant (142-144).

The maintenance of clinical notes separate from other departments within a hospital has meant that GUM clinics have been able to implement EHRs without being dependent on the rest of the hospital. This clearly has advantages including the ability to adapt the EHR to the individual clinic’s needs and introduce it in a timely manner. However, disadvantages include limited funding, the need to rely on separate general hospital based systems to get laboratory and medical imaging results and, in some cases, separate systems for HIV and sexual health

patients. Health Level 7 compatibility, whereby systems are able to communicate with each other using standardised processes(145), is a relatively new concept and at present is unusual within sexual health. Instead it is not uncommon for a clinician to need several different pieces of software open to manage an individual patient(46).

In order to facilitate and improve partner notification, web-based interventions, for example inSPOT (146), have been introduced. Index patients are able to send e-cards to their sexual partners, with the option to send them anonymously if preferred. inSPOT was originally developed for MSM, with an initial evaluation showing promising results with just under 50,000 e-cards being sent(146). Kerani conducting a randomised controlled trial to establish the efficacy of this method and patient-delivered partner therapy for MSM diagnosed with chlamydia and gonorrhoea. The study was terminated early because of low recruitment with the authors concluding that inSPOT was unpopular with this population(147). A website (www.letthemknow.org.au), offering email and SMS as methods for partner notification, and targeting heterosexual men and women, was launched in 2008. Bilardi et al conducted an evaluation of this service, finding that the website was visited 6481 times over a 10 month period. 108 email and 2727 SMS messages were delivered, with the site becoming increasingly popular during the 10 month period(148).

Currently there is a wide variation in what questions people are asked, and how they are managed, in the NHS in the UK depending on whether they present to, a sexual health clinic, obstetrics & gynaecology clinic or ward, GP, NSCP chlamydia screening office or a pharmacy. Standardisation of the questions asked will encourage greater equity of care, and it has been shown that there are fewer missed questions, and greater internal consistency, when using computer-assisted self-interviews compared to pen-and-paper interviews (40;149;150).

Studies have shown that computer-assisted self-interviews are a good way of collecting reliable sensitive data (40;151-154). However, they have found that complex patients are better being assessed in a face-to-face interview (40;152). Concerns have been raised that

patients may lie when completing a questionnaire without a clinician present. Studies do not corroborate this, with high risk behaviour being identified more commonly, or at least similarly, by computer-assisted self-interviews than by face-to-face interviews (40;151;152;155-157). In addition patients reported that they felt it allowed more candid responses (156), and this is confirmed with Langhaug et al finding that there is less reporting bias of self-reported sexual behaviour when patients used audio computer-assisted self-interviews compared to other questionnaire methods(158).

In 2002 Tideman et al, when surveying patients views on the use of computers in a sexual health setting, found that 80% of patients expected computer technology to be used in clinic and that patients were less willing to use a computer to give details of their sexual history (21%), than to give details of their general health (7%) and registration details (9%)(159). In Shoveller et al's qualitative work one youth explained how a physician 'probing' and reacting to facial expressions meant that he was far more forth coming in a face-to-face interview , and that it is not possible to replicate this using a questionnaire(160).

Private providers of online eSexual Health services

An increasing number of pharmacy-based and other private sexual health services offer people the opportunity to access both STI self-sampling and self-testing kits and treatment online for a fee. These services differ from NHS sexual health services in several fundamentally important ways. Users of these services can choose which array of organisms they want to be tested for. For example, Superdrug Online Doctor offers a range of services from testing for genital chlamydia to what they describe as an 'extended STI test kit'. The latter includes testing for chlamydia, gonorrhoea, genital herpes, trichomonas, *Gardenella vaginalis*, mycoplasma and ureaplasma (161) the latter three organisms are not routinely tested for within in NHS settings . They do not provide information on which species of mycoplasma and ureaplasma are being tested for, the sensitivity and specificity of the tests, nor inform people that *Gardenella*

vaginalis is currently not classified as an STI. Treatment provided by private online providers has recently been brought into question when it was discovered that seven online providers were offering sub-optimal therapy for people diagnosed with *Neisseria gonorrhoeae* with Cefixime instead of Ceftriaxone (162;163).

3.2 eSEXUAL HEALTH – THE POTENTIAL BENEFITS AND DRAW-BACKS

Access

As well as eHealth having led to changes in the way that specialist GUM clinics are organised and run, there has been a rise in the number of chlamydia tests that are being requested online via the NCSP, and private providers offering online STI testing(164). Patients are also able to pick up self-sampling test kits at some Sexual Health Clinics. However, at present, irrespective of method of testing, management of positive results requires users to be seen either face-to-face in a GUM Clinic, at their GP, in private consultations having a doctor review the information prior to prescription being issued, or patients accessing treatment via a patient group direction (“a legal framework that allows some registered health professionals to supply and/administer a specified medicine to a pre-defined group of patients, without them seeing a doctor (or dentist) at their local community pharmacy”). In addition, there continues to be a wide variation in the care and follow-up a patient receiving positive chlamydia results receives, treatment outcomes and partner notification levels, within these services (137).

Of concern is the potential for digital technology and eHealth to produce a digital divide, making it harder for vulnerable, most at risk, people to access care(165). Although 88% of 16-24 year olds have smartphones, this means that more than 1 in 10 young adults do not own one, and there is an established digital divide in terms of smartphone ownership and socio-economic group (see page 18)(6). This is of particular concern as it is unknown whether those

young people who do not have access to a smartphone have access to other modalities which they can easily access the internet from, and whether it is those people at highest risk of STIs who have poor poorest access to digital technology. What is known is that there are lower rates of chlamydia testing in more deprived areas despite higher rates of diagnosis compared to less deprived areas (Ref NATSAL). Further research is required before resources are diverted from existing programmes targeting this group of people, to finance new interventions, without sufficient evidence for the effectiveness of the latter.

Stigma

The stigma and discomfort associated with a person being questioned about and discussing their sexual behaviour, both in a clinic setting and in their home (for example with the National Survey of Sexual Attitudes and Lifestyles (NATSAL) study), has led to the development of (audio) computer assisted self interviews (ACASI/CASI) in a research and clinical context (40;150-153;155-157;166-173).

For some, specialist GUM clinics can be places people are reluctant to access because of the stigma and perceptions attached to them. Scoular et al, in their qualitative study of women's perceptions on GUM services, describe three main themes that emerged from their interviews: 1. 'other' people suffered from conditions that required one to access these services; 2. GUM clinics are intimidating and places to be avoided; 3. the humiliation associated with attending GUM clinics(174).

By making testing more sociably acceptable, increasing the range of methods available where people are able to access testing, and with one of these options potentially being able to both access your test and being managed online, therefore removing all personal interaction, the hope is that more people will access testing.

Confidentiality and Privacy

Long acknowledged as an important issue within sexual health(138), confidentiality and privacy continue to be of prime importance (175-180). Researchers from the eSTI² consortium

undertook a qualitative study using semi-structured qualitative interviews with young people at Further Education Colleges at the beginning of the programme to establish acceptability of the eSTI² concept. Privacy was reported as being more important than confidentiality, the latter was felt to be intrinsic with the NHS brand(176). Findings from focus groups conducted by a human computer interface researcher, to inform the design of the interface of a mobile application, as part of the eSTI2 consortium concurred with this(181). At the moment young people inherently believe that the NHS is confidential, and can therefore be trusted, and their fear is that friends or family may read SMS messages from the eSexual Health Clinic, leading to a breach of their privacy(181). We have an obligation to maintain this concept and to reinforce, and build, their trust in the confidentiality and privacy of the service provided.

Communication

eHealth has revolutionised the interaction between patients / users and health care professionals, both in terms of appointment reminders and facilitating access to health promotion, testing, results and partner notification. This has been driven in part by the reasons described above, but also by the GUM clinic clientele, who are mostly young people with low levels of comorbidity and who are *au fait* with using mobile and internet technology.

Examples of where eHealth has been incorporated into routine GUM clinic practice include SMS reminders for appointments, which has shown to reduce non-attendance at clinics(182), and SMS reminders to men who have sex to men to remind them to access STI testing. Other examples where SMS services are used within sexual health include provision of test results. In some cases this is linked to the laboratory where the test is processed so that results are provided to patients and to the clinic in real time.

It is clear that young people accessing online sexual health services want the interface to be presented professionally and seriously(183), and have low tolerance of methods that they feel are out-dated.

Example of existing online sexual health services

In the UK, an increasing proportion of chlamydia screening tests are being requested via the internet(164), and in the US Gaydos et al have shown the potential and acceptability of online testing with their website (<http://www.iwantthekit.org/>)(184-187). The latter is the closest model to the eSTI² chlamydia online clinical care pathway. Originally designed as a way for women to access internet-based self-sampling test kits, in 2014 Spielberg et al published the results of a study, conducted in California, exploring the acceptability and feasibility of an online system for the testing, management and integration of STI care (188). This paper was published after the methodology described in Chapter 3 had been implemented, and does not describe the online treatment in detail. The study involved only small numbers of participants with a diagnosis of a STI ($n=8$) and required a clinician to fax a prescription to a pharmacy (188). However, it will provide a useful comparison to the eSTI² study.

4 eSTI²

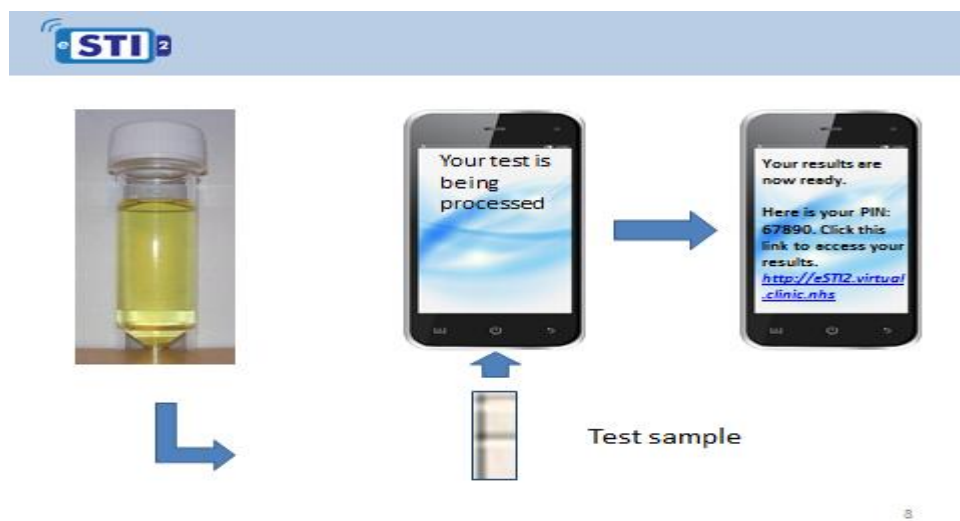
The eSTI² Consortium is divided into four main work streams: Work stream 1 – Microbiology; Work stream 2 – Micro-engineering; Work stream 3 – Diagnostic evaluation; Work stream 4 – Clinical and public health.

My doctoral research lies within Work stream 4, whose initial objectives were set out as follows: *'Guided by the MRC framework for developing and evaluating complex interventions we will assess regulatory, clinical, and economic constraints of eSTI² community testing and develop a wireless-web-based system for clinically managing STI diagnosis. We will conduct a community-based proof-of-concept study of eSTI² deployment. Findings will inform WS [work stream] 1 and WS [work stream] 2 and further technological development of mobile-interfacing rapid diagnostics, in preparation for future community-based trials'*(189).

Within the eSTI² (electronic self-testing instruments for sexually transmitted infections) consortium we are developing an eHealth point-of-care test for *Chlamydia trachomatis*. We envisage this being a home test linked via mobile technology to a results service, online clinical consultation, antibiotic treatment and partner notification.

Figure 1 illustrates the initial eSTI² pathway concept, from testing to accessing results.

Figure 1: The eSTI² pathway from testing to results

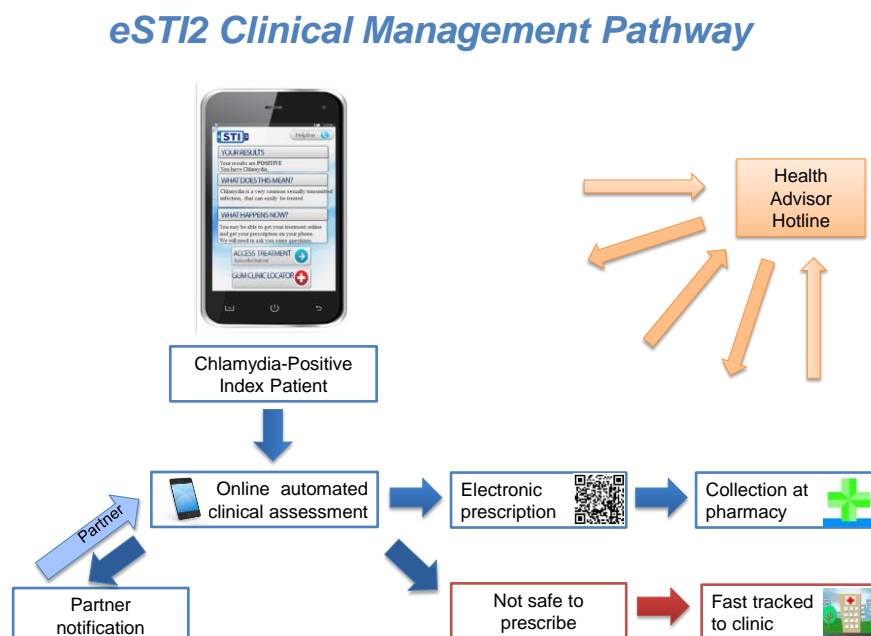


There is a gap in the literature with regards to whether an online results service, clinical consultation and provision of an electronic prescription is acceptable, feasible and whether it can adequately, safely and securely replace current methods of results notification and a consultation with a health care professional. There is a lack of evidence on the best way to phrase the online medical and sexual history questions asked in this context. In addition, there are no guidelines on how to evaluate or accredit an online clinical consultation and currently in the UK there is no accrediting body for this type of pathway.

My work within Work stream 4 has developed a novel online clinical care pathway for the management of people with genital chlamydia. Clearly this is a multidisciplinary effort, in which I worked with other eSTI² researchers who all contributed different expertise. I describe in detail the precise elements I did or I led on and where responsibility was shared. Figure 2

below illustrates the basic eSTI² online clinical care pathway which underpins all subsequent discussion.

Figure 2: A basic outline of the eSTI² chlamydia clinical care pathway



The eSTI² Chlamydia Online Clinical Care Pathway has now been piloted in an exploratory study involving patients who have accessed testing via traditional Sexual Health Clinics and via National Chlamydia Screening Programme internet postal testing. This is discussed in more detail in Chapter 4. At the time of submission this study has completed recruitment and analysis is underway.

Chapter 2: Content and accuracy of currently available mobile medical applications for sexually transmitted and other genital infections: a comprehensive review

This chapter is composed of the following components:

1. Background
2. Definitions
3. Aims of this study
4. Methods
5. Results
6. Discussion

1 BACKGROUND

The number of people in the UK who own a smartphone continues to rise year on year, with 61% of adults possessing one in 2014(6). Young adults are more likely to own mobile phones (99% of 16-34s) or smart phones (88% of 16-24s) compared to their older counterparts (6).

The incidence of sexually transmitted infections (STIs) is highest in those under 25 years (97) and therefore, with the increasing number of internet websites and mobile phone apps geared towards providing information on health-related subjects, it is natural there has also been an expansion in the provision of online resources and apps for consumers seeking information on sexual health. Evidence-based online resources include NHS websites (e.g. <http://www.nhs.uk/conditions/sexually-transmitted-infections/pages/introduction.aspx>), health promotion websites (e.g. Sexunzipped(190)) and sexual health charity websites (e.g.

<http://www.fpa.org.uk/>)(191). There are also a number of private providers who offer online information on, and testing for, STIs (e.g. Dr Thom) (192)

The 2012 press release from the Department of Health proposing that in the near future General Practitioners would be prescribing apps to facilitate self-management of long-term conditions (193) brought into question whether currently available apps are fit for this purpose(66). Although there are understandable concerns surrounding inaccurate medical apps *per se*, apps that purport to be diagnostic or for acute conditions, where people may not seek advice elsewhere, pose particular concern. One example that highlights this issue well is the inaccuracy of currently available smart phone apps designed for non-health care professionals to use to assess whether pigmented cutaneous lesions are melanomas or not (194). There is a growing literature on medical mobile phone apps in the UK and a number of reviews have been conducted in different medical fields (66-68;70;73;195-201).

Currently the UK lacks a robust framework specifically designed to evaluate mobile medical apps (66;75;194). Two bodies have evaluated apps to date:

1. NHS England has introduced a library of NHS-reviewed mobile phone apps (NHS choices health apps library)(202). The website (<http://apps.nhs.uk/review-process/>) describes a five-step review process which apps accepted into the library must satisfy:

1. Submission of the app for assessment
2. Team review (assesses what the app does)
3. Clinical review (if the team feel this is required)
4. Approval or rejection
5. Ongoing review ('the app listing is reviewed on a regular basis and if a user flag concern to us'(203))

However, no further information is provided on who is involved in the review team, what the clinical review entails, and how frequently the app listings are reviewed(203).

2. The Medicines and Healthcare Products Regulatory Agency (MHRA) approved its first app (Mersey Burns) in January 2013. However, MHRA approves medical devices, not apps per se. In this case, the Mersey burns app calculates percentage of body area burned and fluid requirements and so the app was classified as a medical device, although no assessment of its clinical content efficacy was made. Clearly many medical apps would not fall into the medical device category. The MHRA's method of defining what is and is not a medical device is an opaque process, further complicating matters (75).

In order to inform development and provide context for the eSTI² Chlamydia-OCCP study, we needed to understand the breadth and quality of available apps for people with sexual health concerns. In 2012, Health Computer Interface researchers, working as part of eSTI² (work stream 4), undertook an initial scoping review focussing on the human computer interface of available apps(204). The result of this scoping review, along with a review of the grey literature, reinforced the need for an assessment of content and accuracy of apps providing information on STIs and other genital infections. I undertook this assessment and present this work here. The lack of a robust framework for reviewing the content and accuracy of mobile medical apps seemed to me to be a striking omission and led me to consider how a system of app accreditation could be developed and implemented.

2 DEFINITIONS

[Smartphones](#) are defined as portable 'personal computers', which allow users to interact with other people and modalities via a variety of media (e.g. SMS, social media, email) and provide them with access to the internet and applications.

An application, known as an ‘app’, has been defined by Boulos et al as a ‘self-contained piece of software coded for a specific purpose and usually optimised to run on a mobile device’ (205).

I have used the term *mobile medical app* to mean any medical or health-related app.

The Medicines and Healthcare Product Regulatory Agency (MHRA) describe *medical devices* as including ‘most healthcare products other than medicines used for the diagnosis, prevention, monitoring treatment of disease, injury or disability. This means everything from artificial hips to wound dressing, incubators to insulin infusers and scanners to scalpels’ (206).

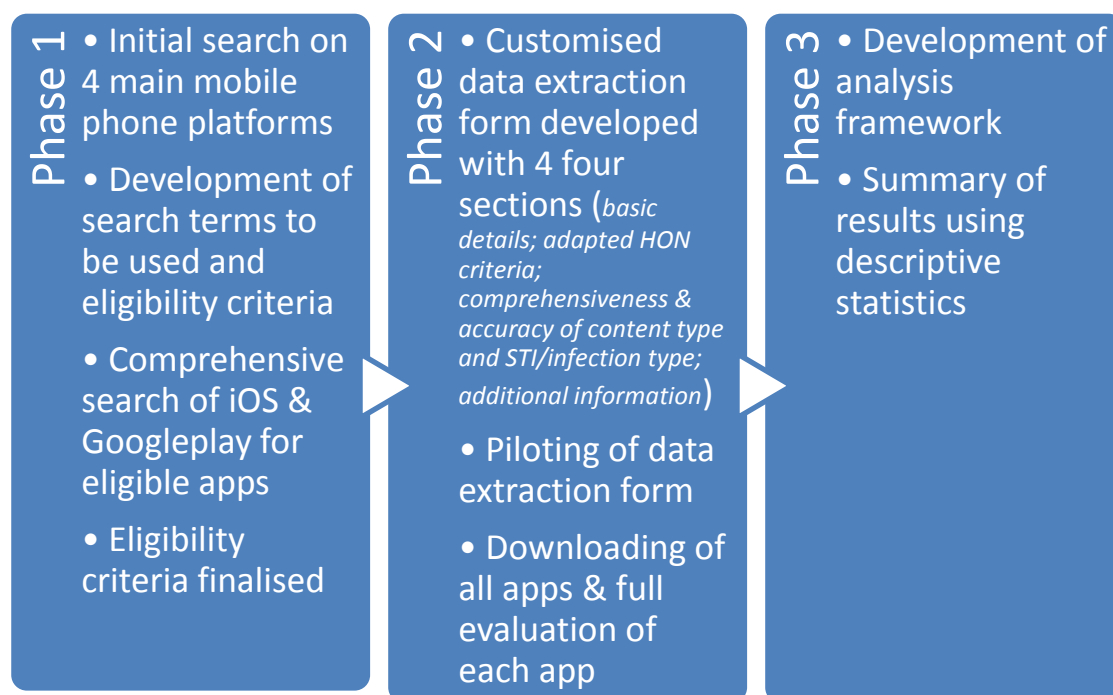
3 AIMS OF THIS STUDY

1. To evaluate the content and accuracy of currently available mobile medical apps for sexual health aimed at the general public
2. To explore the need for standards to accredit mobile medical apps for sexual health and how this might be implemented

4 METHODS

The methods I used have been adapted from Huckvale et al(66), Abrams et al(70;207) and Muessig et al(64),as discussed below. I have divided this into three phases as shown in Figure 3 and described in detail below.

Figure 3: Summary of methods used for mobile medical app review



4.1 PHASE 1: SEARCH

4I conducted an initial search for apps within Apple iOS, Google Play of Android, Blackberry World of Blackberry and Windows Phone Apps and Games Store of Microsoft using the following search terms, which included all of the common STIs, genital infections, and genital syndromes in the UK along with more general terms to used describe STIs and safe sex, between 17/08/14-05/09/14 (see Table 2).

Inclusion criteria at this stage consisted of all apps that appeared related in any way to STIs or sexual health, were in the English Language and were developed for members of the public, not healthcare professionals. I considered whether to only include apps that were developed within the United Kingdom and were therefore under the legal and regulatory control of the UK. However, people living within the UK are able to freely access apps that are developed

Table 2: NHS Evidence database thesaurus terms used in initial search

General terms	Specific terms	
Sexually transmitted diseases	Condoms	Non- specific urethritis
STD	Chlamydia	NSU
STDs	Gonorrhoea	Non- chlamydial non-gonococcal urethritis
STI	Syphilis	NCNGU
STIs	HPV	Pubic lice
Sexual infection	Genital warts	Crabs
Sexual health	HSV	Trichomonas
Safe sex	Genital herpes	Trichomonas vaginalis
Safer sex	Mycoplasma	TV
	Mycoplasma genitalium	

anywhere in the world and I felt that this was an important point to highlight and not to exclude. Irrespective of the regulation of apps within the UK, people will still be able to access apps from other countries. When a search hit on an app that was more general in nature than STIs and HIV but was still relevant (e.g. Virus Encyclopedia), the app was included.

From the results of this initial search, I amended the search terms and eligibility criteria. I chose to exclude 'TV' (see table below) as a search term as it captured all apps related to television (which also uses the abbreviation TV) and did not add any apps that had not been captured within the more specific search terms used. In addition I decided to only include apps from iOS and Google Play store. The rationale for this was the paucity of relevant apps in Blackberry and Windows world and the small proportion of the market that these platforms hold.

Using my amended search criteria, I searched for mobile phone apps between 10/09/14-16/09/14. I was assisted by two senior medical students whom were trained to meet the core national learning outcomes in sexual and reproductive health and HIV (208) prior to commencing the study. This was achieved by passing their Queen Mary University of London undergraduate core sexual health and HIV programme, and was supplemented with clinical

sessions in Barts Health Sexual Health Services. The revised search terms are shown in Table 3 below.

Table 3: Amended search criteria

General terms	Specific terms	
Sexually transmitted diseases	Condoms	Non- specific urethritis
STD	Chlamydia	NSU
STDs	Gonorrhoea	Non- chlamydial non-gonococcal urethritis
STI	Syphilis	NCNGU
STIs	HPV	Pubic lice
Sexual infection	Genital warts	Crabs
Sexual health	HSV	Trichomonas
Safe sex	Genital herpes	Trichomonas vaginalis
Safer sex	Mycoplasma	Pelvic inflammatory disease
	Mycoplasma genitalium	Epididymitis

One researcher searched using the iTunes store and the other researcher searched using Google play; I searched using both platforms. Thus, two researchers were used to search each platform. This was important to reduce the possibility of missing relevant apps and in an attempt to minimise subjectivity. Data, collected from the developer's description in the relevant apps store, was extracted on the following information, using similar criteria to those used in other studies (64;66) (see Table 4)

Table 4: Basic data extraction table

Title of app	Publisher	Number of downloads	Rating	Number of ratings	Age restriction	Theme (e.g. health and fitness)	Price (£0.00)	Last updated	Author's description

I combined and compared all the results gathered and we discussed any discrepancies, and made a final decision as to whether the app in question was to be included or excluded. I made a further refinement of the inclusion and exclusion criteria at this stage, utilising the knowledge that we had gained during the search phase. The finalised eligibility criteria are

shown in Table 5 below. The major difference from the search phase was the need to exclude apps that:

- a) Were in the form of a game or only contained trivia
- b) Covered information on sex that was unrelated to infections or safe sex
- c) Focussed specifically on contraception and did not contain information on infections or safe sex
- d) Contained information specific to a country outside the UK and Ireland.

It only became apparent that these exclusion criteria were necessary once we had started searching the app stores.

Table 5: Inclusion and exclusion criteria

Inclusion criteria:
<ol style="list-style-type: none"> 1. Content or tools addressing one or more aspects of sexual health promotion/safe sex advice, STI testing, diagnosis, management or support, partner notification 2. English Language 3. Available on UK Apple iOS or Google play 4. Free and paid apps
Exclusion criteria
<ol style="list-style-type: none"> 1. Explicitly disclaimed use for a health-related purpose or that are categorised as 'Entertainment', 'Games', 'Casual' or 'Puzzle' 2. Apps that are specifically developed for health care professionals 3. No original content (i.e. only links to secondary source) 4. Focussed solely on HIV/AIDS 5. Focussed solely on sexual positions, performance, technique, or sex trivia 6. Focussed solely on sexual dysfunction 7. Focussed solely on fertility and ovulation checker 8. Focussed solely on contraception or condom size 9. General health or infection apps that are not specifically looking at STIs or sexual health 10. Could not be downloaded because of country restrictions that prevented access in the UK 11. Could not be used because of technical problems with the app, after two attempts 12. Sexual health clinic/condom locators outside the UK 13. Paid apps which are a paid version of a free app without adverts 14. App requires a username and password or creating an account to use it

4.2 PHASE 2: DATA EXTRACTION

In order to collect, analyse and evaluate the data, I developed a customised data extraction form described in detail below. The information that had already been gathered formed the first section of the data extraction form (see Table 7 below). At this stage I added country, region, researcher's own description of the app, target audience and include/exclude to this section.

I decided to base the second section of the data extraction form on existing criteria that are common to all health apps (see Table 8 below). Having reviewed the literature, I concluded that the framework which best met the needs of this review was Huckvale's and Lewis's adaptation of the Health on The Net (HON) Foundation principles for health information on the internet (66;209). It contains 19 criteria and uses existing accepted best practice guidelines that are used for information on the internet and can be easily adapted and satisfy the needs of medical apps. I added whether the app had been approved by NHS Choices health apps library or not as an additional criterion.

Assessment of content and accuracy of apps

I started by assessing the apps according to two broad categories:

1. Comprehensiveness of information
2. Accuracy of information

This assessment was designed to measure the apps against the degree to which they provided comprehensive and accurate information on STIs and genital infection for **non-healthcare professionals**.

As my review aimed to consider whether a lay person seeking STI information would receive accurate, comprehensive information on the STIs/infection in question, I compared the content and accuracy against specifically designed patient and public information sources from NHS Choices*, the British Association of Sexual Health and HIV (BASHH)** and the Family

Planning Association (FPA)*** (see Table 6). I decided that content based on evidenced based guidelines was not an appropriate medium to compare these apps against as evidence based guidelines are aimed at health care professionals and this study focussed on applications aimed at 'lay people'.

Initially I divided the criteria into terms concerning management of STIs (e.g. testing, diagnosis, treatment, partner notification) and coverage of different types of STIs, common genital infections and syndromes (see Tables 9 and 10).

At this stage *Mycoplasma genitalium* was removed from the review as there is no information on this infection in any of the sources mentioned above.

NHS Choices is a website provided by NHS England which provides 'a comprehensive health information service' for the public. It is certified by the Information Standard(1). ** BASHH is 'the UK's leading professional organisation dealing with all aspects of Sexual Health Care'(2). * FPA is a sexual health charity which provides 'straightforward information, advice and support on sexual health, sex and relationships to everyone in the UK'(3)*

Table 6: patient and public information sources

STI/Genital infection/ safe sex	BASHH patient information leaflet	NHS Choices webpage	Family planning association leaflet
Chlamydia		http://www.nhs.uk/conditions/Chlamydia/Pages/Introduction.aspx	http://www.fpa.org.uk/sites/default/files/chlamydia-information-and-advice.pdf
Gonorrhoea		http://www.nhs.uk/conditions/Gonorrhoea/Pages/Introduction.aspx	http://www.fpa.org.uk/sites/default/files/gonorrhoea-information-and-advice.pdf
Syphilis		http://www.nhs.uk/conditions/Syphilis/Pages/Introduction.aspx	http://www.fpa.org.uk/sites/default/files/syphilis-information-and-advice.pdf
Genital warts		http://www.nhs.uk/conditions/genital_warts/Pages/Introduction.aspx	http://www.fpa.org.uk/sites/default/files/genital-warts-information-and-advice.pdf
HPV		http://www.nhs.uk/conditions/vaccinations/pages/hpv-human-papillomavirus-vaccine.aspx http://www.nhs.uk/conditions/genital_warts/Pages/Introduction.aspx	http://www.fpa.org.uk/sites/default/files/genital-warts-information-and-advice.pdf
Genital herpes		http://www.nhs.uk/conditions/Genital-herpes/Pages/Introduction.aspx	http://www.fpa.org.uk/sites/default/files/genital-herpes-information-and-advice.pdf
Pubic lice		http://www.nhs.uk/conditions/pubic-lice/Pages/Introduction.aspx	http://www.fpa.org.uk/sites/default/files/pubic-lice-scabies-information-and-advice.pdf
Trichomonas vaginalis	http://www.bashh.org/documents/TV%20PIL%20Screen%20-%20Edit.pdf	http://www.nhs.uk/conditions/trichomonas_vaginalis/Pages/Introduction.aspx	http://www.fpa.org.uk/sites/default/files/trichomonas-vaginalis-information-and-advice.pdf

STI/Genital infection/ safe sex	BASHH patient information leaflet	NHS Choices webpage	Family planning association leaflet
Vaginal candidiasis		http://www.nhs.uk/conditions/thrush/pages/introduction.aspx	http://www.fpa.org.uk/sites/default/files/thrush-bacterial-vaginosis-information-and-advice.pdf
Bacterial vaginosis	http://www.bashh.org/documents/BV%20PIL%20Screen%20-%20Edit.pdf		http://www.fpa.org.uk/sites/default/files/thrush-bacterial-vaginosis-information-and-advice.pdf
Non-specific urethritis		http://www.nhs.uk/conditions/non_specific_urethritis/pages/causes.aspx	http://www.fpa.org.uk/sites/default/files/non-specific-urethritis-information-and-advice.pdf
Safe sex		http://www.nhs.uk/conditions/contraception-guide/pages/male-condoms.aspx http://www.nhs.uk/conditions/contraception-guide/pages/how-do-i-use-condom.aspx	http://www.fpa.org.uk/sites/default/files/oral-sex-and-sexually-transmitted-infections.pdf http://www.fpa.org.uk/sites/default/files/your-guide-to-contraception.pdf http://www.fpa.org.uk/sites/default/files/male-and-female-condoms-your-guide.pdf
General sexual health		http://www.nhs.uk/conditions/sexually-transmitted-infections/pages/introduction.aspx	http://www.fpa.org.uk/sites/default/files/your-sexual-health-where-to-get-help-and-advice.pdf
Pelvic inflammatory disease		http://www.nhs.uk/conditions/chlamydia/pages/complications.aspx http://www.nhs.uk/conditions/pelvic-inflammatory-disease/pages/introduction.aspx	
Epididymitis		http://www.nhs.uk/conditions/chlamydia/pages/complications.aspx	

These sources generally include information on aetiology, transmission, symptoms, testing, diagnosis, treatment, partner notification, complications, safe sex and service provision.

Having looked at the coverage of the information provided by BASHH, the FPA and NHS choices, and having taken into account what we wanted to know from the perspective of the eSTI² consortium, the parameters I chose to include in the assessment of coverage of content of the apps were: safe sex; testing, diagnosis, information about STIs/infection, management,

partner notification, ePrescribing, contraception and service provision. The definitions of these different parameters can be found in Table 9.

I assessed each content criterion, in a similar manner to Huckvale et al (66) and Abrams et al (207), as being **comprehensively covered**, **partially covered** or **not covered**. I defined completely comprehensive as the app provided information on all or the majority (i.e. more than 75% or three or more) of aspects of the parameter. I defined partially comprehensive as the app covered information on one or more aspect of the parameter, and absent as no information provided on the parameter.

I assessed accuracy as completely accurate (all information is accurate), majority accurate (errors in only one aspect of the information (e.g. testing) and no more than two minor errors), partially accurate (errors in more than one aspect of the information or more than two minor errors) and not accurate (completely inaccurate). In the absence of any guidelines, this was an arbitrary stratification.

I piloted my final app evaluation framework for sexual health apps which met the eligibility criteria, with five iOS apps and five Android apps, which I downloaded at this stage.

The two researchers piloted the evaluation framework with the same apps with one researcher assessing the iOS apps and one researcher assessing the Android apps. I reviewed the results and amended the data extraction table as necessary. The finalised data extraction table is shown in Tables 7 to 11 below.

Table 7: Data extraction table for basic details

Section	Parameter	Coding	Description
Basic details	Title of App	Text	
	Developer	Text	Name of software publisher (e.g Gooplay Apps)
	Country	Text	Country app designed in
	Region	Text	Region app designed for (e.g. Wirral)
	Version	Numerical	
	Number of downloads	Numerical	This is only available for Android apps
	Rating	Numerical	
	Number of ratings	numerical	
	Age restriction	text or numerical	Numerical for iOS, text for Android
	Theme (e.g. health and fitness)	Text	
	Price (£)	numerical (£0.00)	
	Last date updated	Date	
	Author's description of app	Text	What is stated in iTunes store or google play store.
	Our description of app	Text	This is your description of the app
	Target audience	1= general public 2 = people with STI 3= parents 4= other	
	Target audience_4	Text (99)=N/A)	
	Include/Exclude	1= include 2= exclude	
	Reason for exclusion	text (99=N/A)	
	General terms (e.g. sexual health)	text (99=absent)	This is a list of the general search terms that the app has been found under
	Specific terms (e.g. chlamydia)	text (99=absent)	This is a list of the specific search terms that the app has been found under
	Number of different terms apps appeared in	Numerical	This is the number of general terms and specific terms that the apps has been found under summed

Table 8: Data extraction of adapted HON criteria *

Section	Parameter	Coding	Description
Adapted HON Criteria	Author named	1 = yes 2= no	The actual author of the app named (not the publisher)
	Training stated	1 = yes 2= no	
	Qualification clearly stated	1 = yes 2 = no	
	Clearly stated that info is supportive and not a replacement	1 = completely 2= partially 3 = absent	
	App mission, purpose and audience stated	1 = completely 2= partially 3 = absent	
	Organisation behind app described, incl purpose and mission	1 = completely 2= partially 3 = absent	
	Privacy policy incl info on how emails are managed if used	1 = completely 2= partially 3 = absent	
	Documented, referenced and dated	1 = completely 2 = partially 3 = absent	
	Medical content date of creation present	1= yes 2 = no	
	Medical content date of modification present	1= yes 2= no	
	Grammar and spelling correct	1 = yes 2 = no	
	All claims backed up with scientific evidence	1 = completely 2= partially 3 = absent	
	App operational	1= yes 2= no	
	Information accessible and clearly stated	1= yes 2= no	
	Method of contacting app publisher	1 = yes 2= no	
	Source/s of funding stated	1 = yes 2 = no 3= not applicable	
	Conflicts of interest and external influences clearly stated in disclaimer	1 = yes 2 = no 3 = not applicable	
	Those with paying banners have advertising policy	1= yes 2= no 3= not applicable	
	Any conflict of interest explained	1 = yes 2 = no 3 = not applicable	
	Approved by NHS choices	1= yes 2=no	

* Health On the NET (HON) Foundation principles for health information on the internet

Table x: Data extraction of comprehensiveness of clinical content

Table 9: Comprehensiveness of content

Section	Parameter	Coding	Description
Comprehensiveness of clinical information		1 = completely 2= partially 3 = absent	Completely = information on all or the majority (i.e. >75% or 3 or more) of aspects to do with parameter; Partial = information on 1 or more aspect to do with parameter but <75%; Absent = no information
	Safe sex	1 = completely 2= partially 3 = absent	Information on health promotion (e.g. condoms) and how to prevent onward transmission of STI/s
	Testing	1 = completely 2= partially 3 = absent	information on where and how you can get tested (blood test/ swabs at clinics etc
	Diagnosis	1 = completely 2= partially 3 = absent	what exactly the tests were/ how they were processed/ what they looked at
	Information about STIs/infection	1 = completely 2= partially 3 = absent	Information about 1 or more STI/infection including on aetiology/pathogenesis, symptoms, prevention, transmission, natural history
	Management	1 = completely 2= partially 3 = absent	Information about accessing treatment, what treatment is required, follow-up etc
	Partner notification	1 = completely 2= partially 3 = absent	Information about the need to inform partners, abstaining from sex until partner treated, look back time for PN
	ePrescribing	1 = completely 2= partially 3 = absent	Able to get an ePrescription or information on this
	Contraception	1 = completely 2= partially 3 = absent	Information about different forms of contraception
	Service provision	1=completely 2=partially 3=absent	Information about where to access clinics, condoms, or contraceptive services.
	Other	Text	List any other aspects that are covered
	Chlamydia	1 = completely 2= partially 3 = absent	Completely = information on all or the majority (i.e. >75% or 3 or more) of aspects to do with parameter; Partial = information on 1 or more aspect to do with parameter but <75%; Absent = no information
	Gonorrhoea	1 = completely 2= partially 3 = absent	
	Mycoplasma	1 = completely 2= partially 3 = absent	
	Genital warts	1 = completely 2= partially 3 = absent	
	HPV	1 = completely 2= partially 3 = absent	
	Genital herpes	1 = completely 2= partially 3 = absent	
	Pubic lice	1=completely 2=partially 3=absent	
	Trichomonas vaginalis	1 = completely 2= partially 3 = absent	
	Vaginal candidiasis	1 = completely 2= partially 3 = absent	
	Bacterial vaginosis	1 = completely 2= partially 3 = absent	
	Non-specific urethritis	1 = completely 2= partially 3 = absent	
	Pelvic inflammatory disease	1 = completely 2= partially 3 = absent	
	Epididymitis	1=completely 2=partially 3=absent	

Table 10: Accuracy of clinical information

Section	Parameter	Coding	Description
Accuracy of clinical information	Safe sex	1= completely 2 = majority accurate 3 = partially accurate 4 = not accurate	Completely accurate = all information is accurate; Majority accurate = errors in only 1 aspect of the information (e.g. testing) or no more than 2 minor errors (i.e. will not impact on patient safety) throughout; Partially accurate = errors in more than 1 aspect of the information or more than 2 minor errors; Not accurate = completely inaccurate
	Testing	1= completely 2 = majority accurate 3 = partially accurate 4 = not accurate	
	Diagnosis	1= completely 2 = majority accurate 3 = partially accurate 4 = not accurate	
	Information about STIs/infection	1= completely 2 = majority accurate 3 = partially accurate 4 = not accurate	
	Management	1= completely 2 = majority accurate 3 = partially accurate 4 = not accurate	
	Partner notification	1= completely 2 = majority accurate 3 = partially accurate 4 = not accurate	
	ePrescribing	1= completely 2 = majority accurate 3 = partially accurate 4 = not accurate	
	Contraception	1= completely 2 = majority accurate 3 = partially accurate 4 = not accurate	
	Service provision	1= completely 2 = majority accurate 3 = partially accurate 4 = not accurate	Assess accuracy by checking at least 2 of clinics/sites listed are accurate
	Chlamydia	1= completely 2 = majority accurate 3 = partially accurate 4 = not accurate	Completely accurate = all information is accurate; Majority accurate = errors in only 1 aspect of the information (e.g. testing) or no more than 2 minor errors (i.e. will not impact on patient safety) throughout; Partially accurate = errors in more than 1 aspect of the information or more than 2 minor errors; Not accurate = completely inaccurate
	Gonorrhoea	1= completely 2 = majority accurate 3 = partially accurate 4 = not accurate	
	Syphilis	1= completely 2 = majority accurate 3 = partially accurate 4 = not accurate	
	Genital warts	1= completely 2 = majority accurate 3 = partially accurate 4 = not accurate	
	HPV	1= completely 2 = majority accurate 3 = partially accurate 4 = not accurate	
	Genital herpes	1= completely 2 = majority accurate 3 = partially accurate 4 = not accurate	
	Pubic lice	1= completely 2 = majority accurate 3 = partially accurate 4 = not accurate	
	Trichomonas vaginalis	1= completely 2 = majority accurate 3 = partially accurate 4 = not accurate	
	Vaginal candidiasis	1= completely 2 = majority accurate 3 = partially accurate 4 = not accurate	
	Bacterial vaginosis	1= completely 2 = majority accurate 3 = partially accurate 4 = not accurate	
	Non-specific urethritis	1= completely 2 = majority accurate 3 = partially accurate 4 = not accurate	
	Pelvic inflammatory disease	1= completely 2 = majority accurate 3 = partially accurate 4 = not accurate	
	Epididymitis	1= completely 2 = majority accurate 3 = partially accurate 4 = not accurate	
	Overall content accuracy	1= completely 2 = majority accurate 3 = partially accurate 4 = not accurate	

Table 11: Summary and additional information

Section	Parameter	Coding	Description
Additional information	App allows interaction with a healthcare professional	1 = yes 2 = no	
	Type of healthcare professional	1 = doctor 2 = nurse 3 = pharmacist 4 = other 99=N/A	Type of HCP app allows contact with
	Contact via email	1= yes 2 = no 99 = N/A	App allows contact via email
	Contact via phone	1= yes 2= no 99= N/A	App allows contact via phone
	Contact via app	1 = yes 2 = no 99= N/A	App allows contact via app
	Able to upload photo	1 = yes 2 = No 99 = N/A	
	Able to share info with SPs	1= yes 2= no	Able to share results/information on app with sexual partners
	Any other comments	Text	Any other comments that you think need mentioning that have not been covered

All the Android apps were tested on an Android mobile phone touch screen and all the iOS apps were tested on an iPhone 4s. The remainder of the eligible apps were downloaded and I reviewed all of the apps ($n=144$) and the two researchers reviewed 26 and 31 apps respectively. A Research Health Adviser, fully trained in sexual health/STIs to Foundation Year 1 (junior doctor) level, was then brought in to review the remaining apps. The study was explained to the Research Health Adviser and a pilot period was again conducted to ensure that both the Research Health Adviser and the researcher were interpreting the different parameters in the same way.

Duplicate apps (when the same app was available on both platforms) were reviewed by both researchers assigned to the app using different platforms.

Where there was a discrepancy of more than one point between scores applied to parameters, I re-reviewed the app and a discussion was held with the other researchers so that the scores were amended to within one point of each other. Where a parameter had been scored as 'absent' by one researcher and had a score applied to it indicating it was present by another researcher, I reviewed the app to see whether the parameter was absent or not and adjusted the scoring appropriately.

4.3 PHASE 3 – ANALYSIS FRAMEWORK

I divided the analysis of the data extracted into the following sections:

1. Basic details and additional information
2. Adapted HON criteria (Health On the NET (HON) Foundation principles for health information on the internet)
3. Comprehensiveness of content
4. Accuracy of content

I performed all analysis using Microsoft Excel and STATA v13.

Basic details and additional information

Descriptive statistics were used to summarise the results in the basic details and additional information sections.

Adapted HON Criteria

The results of the two researchers who assessed each app were compared for both apps and any discrepancies in scoring were discussed and resolved. Descriptive statistics were then used to summarise the results. The number of HON criteria met by each individual app was summed (maximum of 19). I then stratified these results in to four strata according to the number of HON criteria met: 1=16-20; 2=11-15; 3=6-10; 4=0-5.

Comprehensiveness of content

Despite the presence of a data extraction table (shown above), it is not possible to remove all subjectivity from the process. To try and reduce this as far as possible I took the following actions:

1. Where the two researchers gave a score to the same app and the same parameter that differed by more than one point, I reassessed the app and parameter

2. The scores from both researchers who assessed an individual app were summed for each parameter assessed. I then graded these scores for comprehensiveness as: 2= complete; 3-4=partial; 6= absent

Descriptive statistics were then used to summarise this data by both analysing the data in terms of individual content parameters, individual apps, and platforms.

Accuracy of content

As with the assessment of comprehensiveness of content, despite the presence of a data extraction table (shown above), it is not possible to remove all subjectivity from the process.

To try and reduce this as far as possible I took the following actions:

1. Where the two researchers gave a score to the same app and the same parameter that differed by more than one point, I reassessed the app and parameter,
2. The scores from both researchers who assessed an individual app were summed for each parameter assessed. I then graded these scores for accuracy as: 2= Completely; 3-4=majority; 5-6=partially; 7-8= not accurate
3. Although each researcher made an assessment of each app's overall content accuracy, in order to get a more accurate idea of the content accuracy of individual apps I summed the scores for each parameter. I initially summed content type and STI/infection type separately and then calculated an overall score. Each of these scores for each app was then divided by the number of parameters covered within each section (and overall for the overall score) for that app multiplied by 8 (maximum score for each parameter), and then multiplied by 100 to produce a percentage. This percentage was then subtracted from 100. As the best score that any app could achieve for an individual parameter was 2, this meant that the maximum overall percentage any app could achieve was 75%. In order to convert this into a percentage out of 100, I then divided the percentage by 75 and multiplied it by 100 to reach a final

overall percentage (see table 42 below: content type accuracy %; STI/infection accuracy%; overall accuracy).

For example, iOS app ID i1 (see tables 31 & 42 covered 6 different content parameters.

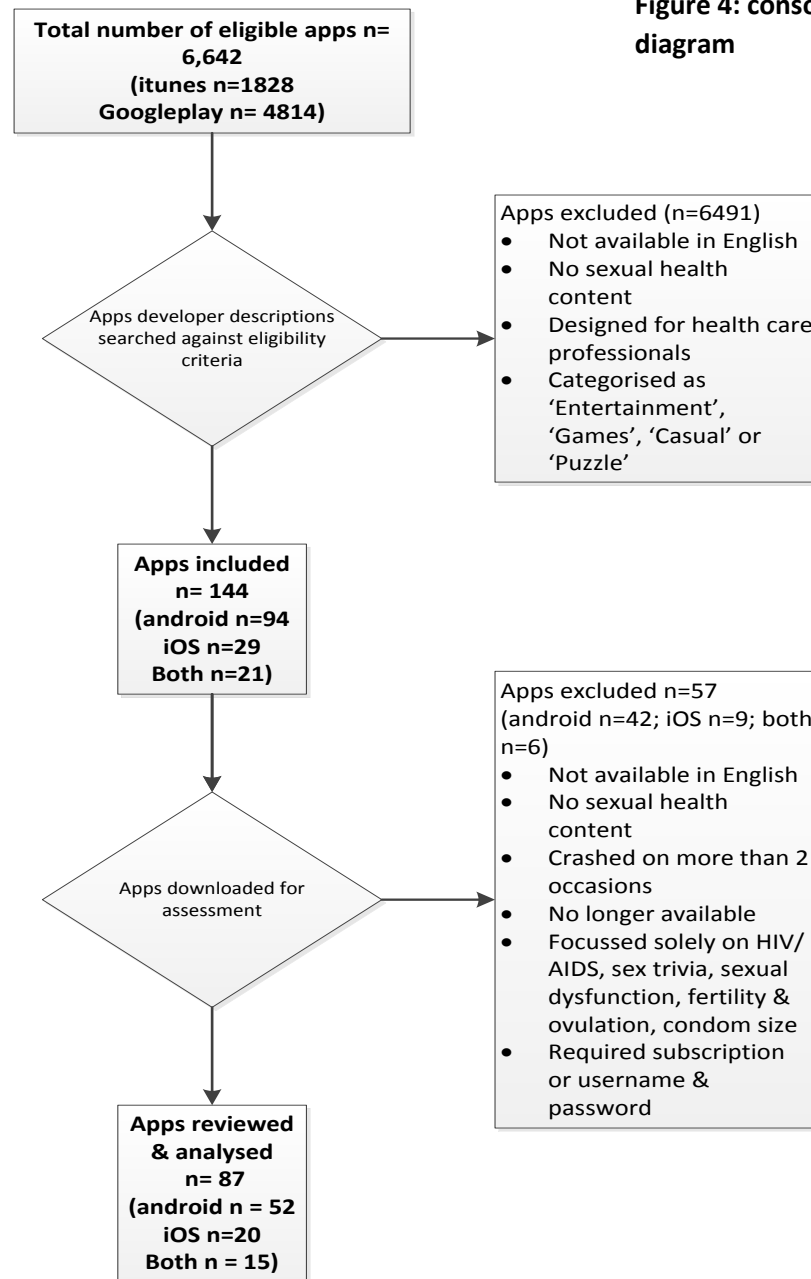
The sum of the accuracy score for these content parameters was 13. I therefore calculated the content accuracy percentage by using the following steps:

1. $13/(6*8)*100 = 27.1\%$
2. $100-27.1 = 72.9\%$
3. $72.9/75*100 = 97.2\%$

5 RESULTS

Using the search terms cited above, we identified 6,642 eligible apps. After screening the app developer's descriptions on the relevant store (iTunes store for iOS apps and Google play for Android apps) against the eligibility criteria, we were left with 144 eligible apps which were downloaded for full review (see Figure 4 below). Of the 144 eligible apps, 65% (n=94) were Android apps, 20% (n=29) were iOS apps and 15% (n=21) were available in both platforms. Once these apps were downloaded, a further 40% (n=57) were found to be ineligible for a variety of reasons (see Appendix I). Of the 87 apps that underwent full review and analysis, 60% (n=52) were Android apps, 23% (n=20) were iOS apps and 17% (n=15) were available in both platforms.

Figure 4: consort diagram



5.1 GENERAL AND ADDITIONAL INFORMATION

Tables 12, 13 and 14 below show the general information collected on the iOS, Android and both platform apps respectively. The number of times each app had been downloaded was unavailable for iOS apps. iOS and Android platforms have different methods of categorising age restriction, with iOS apps having a numerical category applied to them and Android apps being categorised as ‘everyone’, ‘high maturity’, ‘medium maturity’ and ‘low maturity’ (see

Table 19). There is no explanation as to how these categories are assigned and what the Android categories mean. When comparing the age restrictions assigned to apps available in both platforms (see Table 20) there is wide variability in terms of the age restriction applied by the two app stores.

Tables 15, 16 and 17 show the additional information that was collected on whether the app provides a method of contacting a healthcare professional (HCP) and, if so, what type of healthcare professional is contactable and which means of contact are available (e.g. email, phone etcetera). In addition, data was collected on whether the app enabled the user to share information with sexual partners and any comments noted by the individual reviewers are recorded in these tables.

There was marked variation in terms of whether the country where the app was developed was named or not depending on platform, with 55% (11/20) of iOS apps, 13% (45/52) of Android apps, and 100% (15/15) of apps available in both platforms having a named country of origin (see Table 18 below). Overall, 62% (54/87) of apps had no country of origin stated and the UK was the prevalent country of origin at 20% (17/87) of apps.

iTunes store provided no information on the number of times an app had been downloaded. Android apps varied in the number of times they had been downloaded from apps which were only downloaded 10 times to apps that were downloaded 50,000 times or more.

The proportion of apps that were rated by users, by awarding a score of a maximum of five stars, varied according to platform (5% (1/20) of iOS apps, 48% (25/52) of Android apps and 93% (14/15) of apps available in both platforms). There were no ratings for the iOS version of the 15 apps that were available in both iOS and Android platforms.

Overall 18 (21%) apps required users to pay a fee to access them, this included: 40% (8/20) of iOS apps; 17% (9/52) of Android apps; 21% (1/15) of apps available in both platforms. The

majority of apps (48% (42/87)) were classified as Health and Fitness and this was consistent between platforms.

51% (44/87) of apps had been updated in the 12 months prior to this search being conducted (see Table 18). A far higher proportion of Android apps (67% (35/52)) had been updated compared to iOS apps (30% (6/20)) or apps available in both platforms (20% (3/15)). With the exception of apps available in both platforms, the majority of apps were targeted at the general public. 25% (22/87) of all apps were classified as targeting 'other' and the majority of these were targeted at either young people in general or young people in a specific region. 67% (10/15) of apps available in both platforms were classified as 'other'.

Only a small proportion of apps allowed interaction with a healthcare professional and the majority of those apps that did allow interaction did not state what type of healthcare professional the user would be in contact with. Only two apps allowed people to share information with their sexual partner.

As well as making general observations, the researchers noted information that they felt was particularly concerning in the comments section of the data extraction table (see Tables 15, 16 and 17). Illustrative 'concerning content' quotes included:

'Genital warts are bad. If they form in a bunch on your genitals, you will have a very bad time getting them treated and your relationships will shatter'

'By sexual behaviour it does not only mean having vaginal intercourse. In fact, homosexuals can obtain this dreaded disease too through anal and oral sex'

'Once women have left untreated with Chlamydia, they become highly likely of acquiring HIV or the human immunodeficiency virus'

'Both the prescription drug Valtrex and some medicinal herbs have been proven to reduce herpes viral shedding in clinical studies..... Certain medicinal herbs may also be beneficial in creating a strong immune response against HSV in non-infected partners'

'Candida (found in yeast infections) can infect your blood, causing an overload of toxins to disrupt your system, wreaking havoc on your mind and body'

Table 12: General information (iOS only)

Platform	App ID	Title of App	Developer	Country	Number of downloads	Rating	Number of ratings	Age restriction	Theme (e.g. health & fitness)	Price (£)	Last date updated	General search terms	Specific search terms	Number of different terms apps appeared in
iOS	i1	Sexually transmitted disease (STD) triage	iDoc24 AB	Sweden	99	No rating	0	12+	Medical	0	05/02/2014	2	2	4
iOS	i2	STD Guide	ViralMesh	USA	99	No rating	0	12+	Health & Fitness	0	17/11/2010	1	4	5
iOS	i3	STD Glossary	Space Monkeys LLC	USA	99	No rating	0	9+	Medical	0	02/06/2011	1	-	1
iOS	i4	iCondom Coventry	Raaza Ltd	UK	99	No rating	0	12+	Health & Fitness	0	11/07/2012	1	1	2
iOS	i5	99 - The Talk	Oneapp Application Studio Inc	USA	99	No rating	0	17+	Books	2.99	23/02/2010	2	-	2
iOS	i6	Safer Sex	Jo Langford	99	99	No rating	0	12+	Education	0	21/11/2013	4	1	5
iOS	i7	STD411	Frank Strona	America	99	No rating	0	17+	Health & Fitness	0	08/12/2010	2	-	2
iOS	i8	Private Girl Tips	KEYsci	USA	99	No rating	0	12+	Health & Fitness	1.49	26/03/2014	1	-	1
iOS	i9	SWISH APP	MyOxygen Limited	UK	99	No rating	0	12+	Medical	0	27/02/2013	1	2	3
iOS	i10	Sex Health Dictionary & Sexual Health Video Lessons	WindyApp Studio	99	99	No rating	0	17+	Health & Fitness	1.99	29/08/2014	1	-	1
iOS	i11	Safesex Guide	Mobile Identity Danmark Aps	Denmark	99	No rating	0	17+	Health & Fitness	1.49	16/02/2011	1	1	2
iOS	i12	Safe sex	ASD Soft	99	99	No rating	0	17+	Medical	0	19/06/2014	1	2	3
iOS	i13	SafeSex101	UCLA Student Media	USA	99	No rating	0	17+	Lifestyle	0	24/02/2013	1	-	1
iOS	i14	SAFE - Safety Awareness for Everyone	Harish Subramanian	99	99	No rating	0	17+	Health & Fitness	0	15/07/2014	1	-	1
iOS	i15	iSex - Sex Education and Terminology	Hassan Hosam	99	99	4	5	17+	Education	1.49	09/09/2009	-	1	1
iOS	i16	Girls's guide for sex myths	Soci solution	99	99	No rating	0	17+	Lifestyle	0.69	07/09/2011	-	1	1
iOS	i17	CaSH 2 U	ICE	UK	99	No rating	0	9+	Health & Fitness	0	17/07/2013	-	1	1
iOS	i18	Pap Test Lite	Elton Nallbati	99	99	No rating	0	4+	Medical	0	16/02/2013	-	1	1
iOS	i19	Natural Yeast Infection Solutions	minervaz	99	99	No rating	0	4+	Health & Fitness	2.49	10/02/2010	-	1	1
iOS	i20	A woman's guide to yeast infections	Aimfire LLC	99	99	No rating	0	12+	Health & Fitness	0.69	26/01/2010	-	1	1

Table 13: General information (Android only)

Platform	App ID	Title of App	Developer	Country	Region	Number of downloads	Rating	Number of ratings	Age restriction	Theme (e.g. health & fitness)	Price (£)	Last date updated	General search terms	Specific search terms	Number of different terms apps appeared in
Android	a1	Abnormal Vaginal Discharge	App D Store	-	-	10	No rating	0	medium maturity	lifestyle	1.25	09/10/2011	0	1	1
Android	a2	About Herpes Simplex Infection	Nick Montano	-	-	50	No rating	0	low maturity	Health & Fitness	0	02/06/2014	0	3	3
Android	a3	After Sex	Sachem Software LLC	-	-	10,000	3.4	42	high maturity	Health & Fitness	0	19/08/2010	2	0	2
Android	a4	Bacterial Vaginosis Disease	Dmitry Grigorinov	-	-	10	No rating	0	everyone	medical	0	25/08/2014	0	2	2
Android	a5	Bacterial Vaginosis Guide	KoolAppz	-	-	50	5	1	everyone	Health & Fitness	3.07	05/10/2011	0	1	1
Android	a6	Bacterial Vaginosis Treatments	TokyInc	-	-	500	4.5	2	medium maturity	Health & Fitness	0	24/06/2014	0	4	4
Android	a7	Chlamydia Disease and Symptoms	Micheal Perterson	-	-	1	No rating	0	everyone	medical	0	24/08/2014	0	1	1
Android	a8	Chlamydia Know it Prevent it Treat it	Kindle Trove Apps	-	-	10	4	2	everyone	Health & Fitness	0	16/06/2014	5	1	6
Android	a9	Deadly Herpes Virus Acyclovir	WebHoldings	-	-	10	No rating	0	low maturity	Health & Fitness	0	21/06/2014	0	3	3
Android	a10	Female Herpes	IMJava Mobile	-	-	1000	4	3	medium maturity	medical	0	18/04/2013	6	3	9
Android	a11	Genital herpes guide	Ashi Company	-	-	10	4	1	high maturity	books and reference	0	28/07/2014	0	3	3
Android	a12	Genital Herpes Information	Naster Solomon	-	-	10	No rating	0	everyone	medical	0	20/08/2014	0	2	2
Android	a13	Genital Herpes Treatment	WebHoldings	-	-	100	4.7	3	medium maturity	Health & Fitness	0	13/06/2014	0	3	3
Android	a14	Genital Herpes Treatment	Ashi Company	-	-	10	No rating	0	high maturity	medical	0	29/07/2014	0	3	3
Android	a15	Genital Warts Guide	Havana Apps	-	-	100	No rating	0	low maturity	Health & Fitness	0	16/05/2014	0	3	3
Android	a16	Genital Warts Guide	Gooplay app	-	-	10	No rating	0	low maturity	Health & Fitness	0	05/06/2014	0	2	2
Android	a17	Genital warts info	Havana Apps	-	-	100	3	2	low maturity	books and reference	0	16/05/2014	0	2	2

Table 13 continued

Platform	App ID	Title of App	Developer	Country	Region	Number of downloads	Rating	Number of ratings	Age restriction	Theme (e.g. health & fitness)	Price (£)	Last date updated	General search terms	Specific search terms	Number of different terms apps appeared in
Android	a18	Genital Warts Info	Gooplay app	-	-	100	No rating	0	low maturity	Health & Fitness	0	05/06/2014	6	2	8
Android	a19	Genital Warts Info	Ashi Company	-	-	10	2	1	medium maturity	books and reference	0	28/07/2014	6	3	9
Android	a20	Genital Warts Information	Naster Solomon	-	-	10-50	No rating	0	everyone	medical	0	20/08/2014	0	2	2
Android	a21	Get Rid of Bacterial Vaginosis	HealthSense	-	-	500	5	4	low maturity	Health & Fitness	0	04/12/2013	0	3	3
Android	a22	Get Rid of Yeast Infection Now !	EclipseBoy	-	-	100	2	1	everyone	Health & Fitness	0	03/11/2013	1	4	5
Android	a23	Gonorrhea Disease & Symptoms	Naster Solomon	-	-	50	No rating	0	everyone	medical	0	20/08/2014	0	1	1
Android	a24	Guide to STDs	KoolAppz	-	-	10	1	1	everyone	Health & Fitness	3.11	13/07/2011	6	4	9
Android	a25	Herpes Knowledge	Gooplay app	-	-	50	No rating	0	low maturity	books and reference	0	15/05/2014	0	2	2
Android	a26	Herpes Lupus Psoriasis Eczema	Yoav Fael	-	-	100	4.5	4	everyone	Health & Fitness	0	01/06/2014	0	1	1
Android	a27	Herpes Treatment	KING APPS	-	-	500	4	4	everyone	Health & Fitness	0	30/05/2013	0	2	2
Android	a28	HPV Infection Information	Naster Solomon	-	-	10	No rating	0	everyone	medical	0	26/08/2014	1	1	2
Android	a29	iGirl	pip90	Uganda	-	100	4.5	2	everyone	Health & Fitness	0	16/06/2013	1	0	1
Android	a30	Knowledge of Herpes	Gooplay app	-	-	10	No rating	0	low maturity	books and reference	0	05/06/2014	0	2	2
Android	a31	No Worries	Smartphone Media	UK	Wiltshire	100	4.7	3	medium maturity	education	0	14/08/2013	7	0	7
Android	a32	NORISKS	dkberry	UK	Suffolk	50	No rating	0	everyone	Health & Fitness	0	22/07/2011	2	1	3
Android	a33	Painful urination in men	ConstantaSoft Inc	-	-	1	No rating	0	everyone	medical	4.33	05/04/2013	2	4	6
Android	a34	Pelvic Inflammatory disease	thaweepong kongkratin	-	-	50	4	3	everyone	medical	0	23/08/2014	0	2	2

Table 13 continued

Platform	App ID	Title of App	Developer	Country	Region	Number of downloads	Rating	Number of ratings	Age restriction	Theme (e.g. health & fitness)	Price (£)	Last date updated	General search terms	Specific search terms	Number of different terms apps appeared in
Android	a35	Protection - Sex	C- Dimensions Ltd	UK	-	5	No rating	0	medium maturity	lifestyle	0.59	24/02/2011	2	0	2
Android	a36	Public Lice Crabs Information	Noppawin sumongdee	-	-	10	4	1	everyone	medical	0	21/08/2014	0	2	2
Android	a37	SAFE	Amphibia	Malaysia	-	1000	4.3	34	medium maturity	Health & Fitness	0	20/05/2014	4	0	4
Android	a38	Safer sex	C- Dimensions Ltd	-	-	10	No rating	0	medium maturity	lifestyle	0.59	24/02/2011	4	0	4
Android	a39	Samedaydoctor - STD Testing	Creast Solutions (UK) Ltd	-	-	0	No rating	0	medium maturity	medical	0	20/08/2014	2	0	2
Android	a40	Sexual Education	Deep Powder Software	-	-	5	No rating	0	medium maturity	Health & Fitness	1.09	31/05/2010	3	0	3
Android	a41	Sexually transmitted Stds	noppawin sumongdee	-	-	100	2.5	4	everyone	medical	0	27/08/2014	7	0	7
Android	a42	Sheffield SH	Diva Creative	UK	Sheffield	100	No rating	0	low maturity	Health & Fitness	0	09/06/2014	1	0	1
Android	a43	STD glossary	Publish This, LLC	USA	Utah	10	4	1	everyone	medical	0.72	16/09/2013	6	0	6
Android	a44	Stop Vaginal Odor	Gallencraft	-	-	10000-50000	4	251	medium maturity	Health & Fitness	0	25/08/2014	2	1	3
Android	a45	Syphilis Disease and Symptoms	Pachara Kongsookdee	-	-	50	3	1	everyone	medical	0	22/08/2014	0	1	1
Android	a46	The Big Book - Symptoms of STD	Jak	-	-	5000	4.1	15	everyone	Health & Fitness	0	24/01/2013	6	0	6
Android	a47	The Sex Guide	C- Dimensions Ltd	-	-	10	No rating	0	high maturity	lifestyle	0.59	24/02/2011	4	0	4
Android	a48	Treat Genital Herpes Naturally	Muhhas	-	-	100	No rating	0	high maturity	Health & Fitness	0	06/04/2014	0	2	2
Android	a49	Trichomoniasis information	Pachara Kongsookdee	-	-	10	No rating	0	everyone	medical	0	25/08/2014	0	2	2
Android	a50	UCT Safe Sex	Information Systems Dept - University of Cape Town	-	-	5000-10000	4.2	53	medium maturity	Health & Fitness	0	09/05/2014	4	1	5
Android	a51	Yeast Infection	Dreamland Apps	-	-	50	No rating	0	everyone	books and reference	0	21/02/2014	1	2	3
Android	a52	Yeast Infection Home Remedy	Karl Evans	-	-	500	No rating	0	everyone	Health & Fitness	0	05/11/2012	1	2	3

Table 14: General information (available in both platforms)

Platform	App ID	Title of App	Author	Country	Number of downloads	Android rating	iTune Rating	Android number of ratings	iTune Number of ratings	Android age restriction	iTune Age restriction	Android Theme	iTune Theme (e.g. health & fitness)	Price (£)	iTune last date updated	Android Last date updated	Target audience	Target audience_4	Android general search terms	iTune general search terms	Android specific search terms	iTune specific search terms	Android Number of different terms apps appeared in	iTune Number of different terms apps appeared in
Both	b1	C&SH Somerset	Scrumplicious	UK	500-1000	4.7	No rating	7	8	Medium maturity	12+	Health & Fitness	Health & Fitness	0	16/08/2014	20/01/2015	4	Young people	1	1	0	0	1	1
Both	b2	Conifer Sex Health	Scrumplicious	UK	100	4.2	No rating	4	99	Medium maturity	12+	health and fitness	health and fitness	0	14/01/2014	17/01/2014	4	People living in Hull & East Riding	7	1	0	2	7	3
Both	b3	FPA - Find a Clinic	FPA	UK	100	5	No rating	3	7	Medium maturity	12+	Medical	Medical	0	05/02/2014	05/02/2014	4	Young people	7	0	3	2	10	2
Both	b4	FREE 2 B ME	East Sussex County Council	UK	50 - 100	5	No rating	1	0	Medium maturity	12+	Health & Fitness	Health & fitness	0	22/02/2013	10/03/2013	4	Young people	5	1	2	2	7	3
Both	b5	Get Them Tested	Codigo Pte Ltd	Singapore	500 - 1,000	4	No rating	2	0	High maturity	12+	Health & Fitness	Health & fitness	0	12/05/2014	12/05/2014	2	99	3	3	0	0	3	3
Both	b6	Kent C Card	Kent Community Health NHS Trust	UK	500 - 1,000	3.7	No rating	3	10	Low maturity	4+	Health & fitness	Health & fitness	0	16/09/2013	16/09/2013	4	Young people	1	1	1	1	2	2
Both	b7	KIS-SK	College Mobile, Inc	Canada	100 - 500	4.7	No rating	3	0	Low maturity	4+	Medical	Medical	0	05/05/2014	05/05/2014	4	Students, young people	1	1	0	0	1	1
Both	b8	KYSH - Know Your Sexual Health	fixers	UK	10 to 50	No rating	No rating	0	0	High maturity	12+	Lifestyle	Health & Fitness	0	16/12/2013	22/11/2013	4	Young people	2	2	1	1	3	3
Both	b9	My Sex Doctor	MYSD LTD	UK	5000	3.7	No rating	73	0	High maturity	12+	Lifestyle	lifestyle	0	26/05/2014	26/05/2014	1	99	2	2	0	0	2	2
Both	b10	NeedTayKnow	99	UK	100	4.9	No rating	7	0	Medium maturity	12+	Medical	education	0	03/01/2014	03/01/2014	4	Young people living in Tayside	3	1	0	0	3	1
Both	b11	SexPositive	University of Oregon	USA	10,000 - 50,000	3.6	No rating	46	0	High maturity	17	Education	education	0	05/09/2014	04/09/2014	4	University students	9	3	0	1	9	4
Both	b12	Sexual Health Guide	Global Internet Radio Technologies	Ireland	50,000 - 100,000	4	No rating	234	0	Medium maturity	17+	Education	education	0	24/07/2012	05/03/2013	1	99	7	2	0	1	7	3
Both	b13	Sexual Health Liverpool	Glow New Media Ltd	UK	50 - 100	4	No rating	1	0	Medium maturity	12+	Health & Fitness	Health & Fitness	0	09/04/2013	16/04/2013	1	99	1	3	0	2	1	5
Both	b14	Your rapid diagnosis STD	WWW Machealth Pty Ltd	Australia	50 - 100	0	0	0	0	Everyone	17	Medical	Medical	£2.99/£3.03	19/10/2011	29/01/2013	2	99	6	3	1	0	7	3
Both	b15	Your Choice Your Voice (YCVV)	Scrumplicious	UK	50 - 100	4.5	0	2	0	Medium maturity	12+	health and fitness	health and fitness	0	07/10/2014	10/10/2014	4	Young people living in bromley	0	1	1	0	1	1

Table 15: Additional information (iOS only)

Platform	App ID	Title of App	Developer	App allows interaction with a HCP*	Type of HCP	Contact via email	Contact via phone	Contact via app	Able to upload photo	Able to share info on SPs	Any other comments
iOS	i1	Sexually transmitted disease (STD) triage	iDoc24 AB	Yes	Doctor	Yes	No	Yes	Yes	No	Clinic locator not accurate or complete, only private clinics. Service provision = send picture of skin concern and get answer from dermatologist within 24h plus clinic locator
iOS	i2	STD Guide	ViralMesh	No	-	-	-	-	-	No	
iOS	i3	STD Glossary	Space Monkeys LLC	No	-	-	-	-	-	No	Under definition of HPV they have the definition of HIV
iOS	i4	iCondom Coventry	Raaza Ltd	No	-	-	-	-	-	No	Information on where to access condoms but no information on how, why & when you need to use them
iOS	i5	99 - The Talk	Oneapp Application Studio Inc	No	-	-	-	-	-	No	
iOS	i6	Safer Sex	Jo Langford	No	-	-	-	-	-	No	Only basic facts on contraception: success rate, brief method of action, effective against STD/pregnancy. No side effects, how to use. States emergency contraceptive pill is two pills 12hours apart. Vaguely implies condoms are only method of preventing STIs
iOS	i7	STD411	Frank Strona	Yes	Unknown	Yes	Yes	Yes	No	No	Simple information on STDs including symptoms. No diagnosis or management.
iOS	i8	Private Girl Tips	KEYsci	No	-	-	-	-	-	No	States to be yeast infection must have itching AND white discharge, wrongly encourages use of baby powder 'down there'. Monistat** is the recommended treatment. States Pap smear to be done yearly (USA).
iOS	i9	SWISH APP	MyOxygen Limited	No	-	-	-	-	-	No	
iOS	i10	Sex Health Dictionary & Sexual Health Video Lessons	WindyApp Studio	No	-	-	-	-	-	No	
iOS	i11	Safesex Guide	Mobile Identity Danmark Aps	Yes	Unknown	Yes	No	Yes	No	No	NSU described as 'urethral catarrh'
iOS	i12	Safe sex	ASD Soft	No	-	-	-	-	-	No	
iOS	i13	SafeSex101	UCLA Student Media	No	-	-	-	-	-	No	Although there isnt a facility to share with partners, the app does have a forum to speak to others about "topics" under a lesson section. Lessons & information section doesn't work
iOS	i14	SAFE - Safety Awareness for Everyone	Harish Subramma niam	No	-	-	-	-	-	No	
iOS	i15	iSex - Sex Education and Terminology	Hassan Hosam	No	-	-	-	-	-	No	In definitions it signposts you to terms that do not exist in the dictionary (e.g. genital herpes) or to a term that you are already in (e.g. diaphragm). In gonorrhoea it tells you about rare complications (without mentioning that they are rare) but doesn't mention common symptoms or the fact that it can be asymptomatic
iOS	i16	Girls's guide for sex myths	Soci solution	Yes	Unknown	Yes	No	No	No	No	
iOS	i17	CaSH 2 U	ICE	Yes	Unknown	No	Yes	No	No	No	Linked to SeX Factor ICE
iOS	i18	Pap Test Lite	Elton Nallbati	No	-	-	-	-	-	No	
iOS	i19	Natural Yeast Infection Solutions	minervaz	No	-	-	-	-	-	No	Very wordy and opinionated. Implies that medical practitioners are likely to mismanage the condition and treat with antibiotics. Potentially dangerous in terms of treatment options.
iOS	i20	A woman's guide to yeast infections	Aimfire LLC	No	-	-	-	-	-	No	Very similar to Natural Yeast Infection Solutions by Minervaz

*HCP, health care professional; SP, sexual partner; ** Monistat a brand name for miconazole vaginal cream

Table 16: Additional information (Android only)

Platform	App ID	Title of App	App allows interaction with a healthcare professional	Type of healthcare professional	Contact via email	Contact via phone	Contact via app	Able to upload photo	Able to share info on SPs	Comments
Android	a1	Abnormal Vaginal Discharge	No	-	-	-	-	-	Yes	Able to click to send email containing the information to someone else. Focus on fertility treatments as well as abnormal discharge which seems strange as the two are not necessarily related.
Android	a2	About Herpes Simplex Infection	No	-	-	-	-	-	No	Quite a lot of scare mongering. Makes herpes sound really horrendous.
Android	a3	After Sex	No	-	-	-	-	-	No	Very good. Links to a website for more information.
Android	a4	Bacterial Vaginosis Disease	No	-	-	-	-	-	No	Pictures/photos with text are incongruous - e.g. on page titled 'definition' there is a picture of a CT scanner
Android	a5	Bacterial Vaginosis Guide	No	-	-	-	-	-	No	Quite scaremongering. Lots of suggestions for natural remedies and natural prevention methods.
Android	a6	Bacterial Vaginosis Treatments	No	-	-	-	-	-	No	Links to external websites included in the app and to You Tube videos.
Android	a7	Chlamydia Disease and Symptoms	No	-	-	-	-	-	No	
Android	a8	Chlamydia Know it Prevent it Treat it	No	-	-	-	-	-	No	Links to website. No content within actual app.
Android	a9	Deadly Herpes Virus Acyclovir	No	-	-	-	-	-	No	
Android	a10	Female Herpes	No	-	-	-	-	-	No	Good information about herpes but then under treatment there are two links to websites selling remedies. Mainly discusses using culture for diagnosing HSV with only a brief mention of PCR
Android	a11	Genital herpes guide	No	-	-	-	-	-	No	Has game at end. One section links to wikipedia with no obvious relevance. Poorly written and contains very little information. Only mentions HSV-2 as a cause of genital herpes.
Android	a12	Genital Herpes Information	No	-	-	-	-	-	No	Excellent accurate comprehensive app which includes what to expect when you see a healthcare professional, coping support, pregnancy, & episodic & suppressive treatment.
Android	a13	Genital Herpes Treatment	No	-	-	-	-	-	No	Same info as genital herpes Ashi
Android	a14	Genital Herpes Treatment	No	-	-	-	-	-	No	Linked to genital herpes guide. Only mentions HSV-2 as a cause of genital herpes. Game at end
Android	a15	Genital Warts Guide	No	-	-	-	-	-	No	Scare-mongering e.g. 'Genital warts are bad. If they form in a bunch on your genitals, you will have a very bad time getting them treated and your relationships will shatter'. Same format as genital warts info.
Android	a16	Genital Warts Guide	No	-	-	-	-	-	No	Contains very little information. Same format and very similar to Havana app
Android	a17	Genital warts info	No	-	-	-	-	-	No	Virus never leaves the body. Much easier to prevent transmission of the virus than to deal with the virus after you have caught it. Multiple inaccuracies & scare-mongering. Link to more information (wikipedia) doesn't work. Game at end.

Table 16 continued

Platform	App ID	Title of App	App allows interaction with a healthcare professional	Type of healthcare professional	Contact via email	Contact via phone	Contact via app	Able to upload photo	Able to share info on SPs	Comments
Android	a18	Genital Warts Info	No	-	-	-	-	-	No	Exactly the same as Genital Warts Info by Havana apps
Android	a19	Genital Warts Info	No	-	-	-	-	-	No	Similar format to Genital warts info by Havana apps. Link to extra information takes you to a wikipedia 'Today's featured article' page
Android	a20	Genital Warts Information	No	-	-	-	-	-	No	
Android	a21	Get Rid of Bacterial Vaginosis	No	-	-	-	-	-	No	Scare mongering. Suggested management includes douching with grapefruit seed extract or hydrogen peroxide. Recommends accessing the bacterial vaginosis freedom guide for further info.
Android	a22	Get Rid of Yeast Infection Now!	No	-	-	-	-	-	No	Very similar to itune yeast apps
Android	a23	Gonorrhea Disease & Symptoms	No	-	-	-	-	-	No	
Android	a24	Guide to STDs	No	-	-	-	-	-	No	When something is sexually transmitted, it means that it has a very significant possibility of being transmitted being animals or human beings through sexual behaviour'. 'By sexual behaviour it does not only mean having vaginal intercourse. In fact, homosexuals can obtain this dreaded disease too through anal and oral sex'. 'Actually, it was only around the 1990's when scientists and medical professionals decided to call sexually transmitted diseases as the venereal diseases'. Refers to STDs as 'a disease' as opposed to individual infections that cause disease. 'Most of the strains of the human papillomavirus cause the onset of cervical cancer. ...' 'Once women are left untreated with Chlamydia, they become highly likely of acquiring HIV or the human immunodeficiency virus'. Re gonorrhoea: 'a huge percentage of the men who have acquired the infection do not exhibit symptoms.' 'Leaving gonorrhea untreated will only affect the infected person's joints and heart valves'. Re Trichomonas: 'The great thing about this disease is that it is the number one most curable sexually transmitted disease in the whole world' & 'Many believe that performing a natural douche once in a day while having a warm bath is very helpful. Actually, they are right. But this method will be much more effective is the juice of a single lemon is added as it increases the liquid's parasite-killing power'. 'Those who usually get infected with the genital herpes virus are the poor, those who are addicts with cocaine, those with multiple sexual mates, and also those who are uneducated'.
Android	a25	Herpes Knowledge	No	-	-	-	-	-	No	Very similar format to Ashi. Discusses genital herpes only being caused by HSV-2. Infers that you get it by having 'careless casual sex with strangers'. Information on how HSV is transmitted is ambiguous. Read more tab links to herpes simplex page on wikipedia. Game at end.
Android	a26	Herpes Lupus Psoriasis Eczema	No	-	-	-	-	-	No	Describes HSV-3 (zoster/shingles)
Android	a27	Herpes Treatment	No	-	-	-	-	-	No	Both the prescription drug Valtrex and some medicinal herbs have been proven to reduce herpes viral shedding in clinical studies. 'Certain medicinal herbs may also be beneficial in creating a strong immune resistance against HSV in non-infected partners'. Incubation period 2-12 days. Women with HSV-2 genital herpes the chance of spreading the virus to a man if they abstain from having sex during outbreaks is approx 3% in a year; for a man to woman - 8%. Video. Estimated 1:4 people in the UK are diagnosed with genital herpes. Genital herpes usually caused by HSV-2. Diet and certain foods can trigger outbreaks. Herpes virus does not pass through latex condoms. If you know that you have come into contact with the virus in the past few minutes or so then simple act of washing the infected area with soap and warm water can help to sweep away the virus from your hands and other areas. By doing this you can help avoid the virus from spreading further. Doesn't mention PCR testing (does mention viral culture, serologic tests and antigen tests). Discusses dietary habits and herbal remedies as ways of managing the infection. Although this app contains a lot of information that is accurate it also contains a lot of information that they claim is backed by evidence and it isn't
Android	a28	HPV Infection Information								
Android	a29	iGirl	No	-	-	-	-	-	No	Excellent comprehensive app. Crashed on 2 occasions. Centres based in Uganda.
Android	a30	Knowledge of Herpes	No	-	-	-	-	-	No	Exactly the same as Herpes Knowledge by Gooplay Apps. Very similar format to Ashi. Discusses genital herpes only being caused by HSV-2. Infers that you get it by having 'careless casual sex with strangers'. Information on how HSV is transmitted is ambiguous. Read more tab links to herpes simplex page on wikipedia. Game at end.
Android	a31	No Worries	Yes	Unknown	No	Yes	No	No	No	Comprehensive coverage of certain STIs and contraceptive methods including emergency contraception. Only app to mention both Ellaone and the IUD as methods of emergency contraception. Also discusses pros and cons of certain contraceptive methods.
Android	a32	NORISKS	Yes	Unknown	No	Yes	No	No	No	
Android	a33	Painful urination in men	No	-	-	-	-	-	No	Uses the term venereal diseases. Able to answer questions re symptoms but repeatedly got pop up box stating 'This application is not licensed. Please purchase it from Android Market' even though I'd paid £4.11 for the app.
Android	a34	Pelvic inflammatory disease	No	-	-	-	-	-	No	

Table 16 continued

Platform	App ID	Title of App	App allows interaction with a healthcare professional	Type of healthcare professional	Contact via email	Contact via phone	Contact via app	Able to upload photo	Able to share info on SPs	Comments
Android	a35	Protection - Sex	No	-	-	-	-	-	No	Initial facts and figures quoted area out of date (references date from 2001) & they have NHS direct number at end rather than 111. In format of leaflet which is not particularly easy to scroll through
Android	a36	Pubic Lice Crabs Information	No	-	-	-	-	-	No	
Android	a37	SAFE	No	-	-	-	-	-	No	Exactly the same as iTunes SAFE app.
Android	a38	Safer sex	No	-	-	-	-	-	No	Not obvious that you need to scroll through it. Clearly designed as leaflet/booklet and has just been transferred straight in to an app.
Android	a39	Samedaydoctor - STD Testing	Yes	Yes	Yes	Yes	Yes	No	No	
Android	a40	Sexual Education	No	-	-	-	-	-	No	Coitus interruptus - can work to prevent pregnancy if done right'
Android	a41	Sexually transmitted Stds	No	-	-	-	-	-	No	Cervical & STI screening is for USA not UK
Android	a42	Sheffield SH	No	-	-	-	-	-	No	Information on condoms links to a You Tube video. Able to send a text to order a chlamydia test kit via the app
Android	a43	STD glossary	No	-	-	-	-	-	No	Contains errors - e.g. definition of male condom = itch; Definition of CT discusses trachoma but fails to discuss genital infection; Doesn't mention that doxycycline is used to treat chlamydia; dysplasia - uses an example of retinal dysplasia to describe term rather than cervical. Only mentions HSV-2 in terms of genital herpes. Under HPV it gives you information on HIV. LN2 - doesn't mention that it is a treatment for warts. Accurate information on LGV. 'Lice do not have feet designed to walk or hold onto smooth surfaces such as toilet surfaces'.
Android	a44	Stop Vaginal Odor	No	-	-	-	-	-	No	The result of PID is a heavy discharge with an extremely noticeable bad smell'. Re Gonorrhea - 'this sexually transmitted disease causes a pus-like discharge that is accompanied with a rotten odor. It's possible to become re-infected even after each partners has been treated for it'. Re Chlamydia - it can also pass to an unborn baby during pregnancy'. Advises using tea tree oil, garlic & panty liners
Android	a45	Syphilis Disease and Symptoms	No	-	-	-	-	-	No	
Android	a46	The Big Book - Symptoms of STD	No	-	-	-	-	-	No	
Android	a47	The Sex Guide	No	-	-	-	-	-	No	Contact numbers for different services are out of date
Android	a48	Treat Genital Herpes Naturally	No	-	-	-	-	-	No	Offer of free video if you provide email address. Very small font.
Android	a49	Trichomoniasis Information	Unknown	-	-	-	-	-	No	
Android	a50	UCT Safe Sex	No	-	-	-	-	-	No	
Android	a51	Yeast Infection	No	-	-	-	-	-	No	Candida (found in yeast infections) can infect your blood, causing an overload of toxins to disrupt your system, wreaking havoc on your mind and body. App finishes by saying that there is a really helpful guide/report but not stating which one this is and not discussing how vulvovaginal candidiasis can be treated.
Android	a52	Yeast Infection Home Remedy	No	-	-	-	-	-	No	The symptoms they describe could also be HSV - e.g. 'burning and tingling sensation' 'make walking, switching positions, urinating and sexual intercourse difficult'. 'Sufferers are more likely to develop allergies inhaling airborne mold. Damp, dark locations can make them feel worse. They may also display a craving for sugar, breads, carbohydrates & alcohol, though sufferers may not necessarily be tolerant to alcohol. But even then these symptoms altogether may make you a candidate for another infection called bacterial vaginosis, which merits its own article.' 'Also, when left unchecked, thrush may cause dangerous side-effects, such as endometriosis, ovarian dysfunction and the release of toxins which may further jeopardize your immune system'. 'But if the yeast in our bodies reach more than the normal levels, that's when yeast infection strikes. Yeast infection causes our bodies to produce too much yeast and is triggered by a fungus called Candida albicans'. 'Vaginal yeast infection happens more to women after menopause'. Treatment and prevention includes dietary advice, apple cider vinegar solution, garlic, cranberry pills, olive leaf and grapefruit seed extract mixed together, raw garlic juice, hydrogen peroxide. Article based on book 'yeast infection no more' by Linda Allen. Repetitive & very lengthy.

Table 17: Additional information (available in both platforms)

Platform	App ID	Title of App	App allows interaction with a healthcare professional	Type of healthcare professional	Contact via email	Contact via phone	Contact via app	Able to upload photo	Able to share information with sexual partners	Additional comments/Notes
Both	b1	C&SH Somerset	2	99	99	99	99	99	2	Partner notification and treatment is only mentioned with regards to pubic lice, scabies and gonorrhoea. Specific names of drug treatments not mentioned. Provides information on where to acquire condoms and GUM services, but does not emphasise importance of regular check up
Both	b2	Conifer Sex Health	1	Unknown	2	1	2	2	2	
Both	b3	FPA - Find a Clinic	2	99	99	99	99	99	2	Information on all STIs not actually in app but in downloadable leaflets. I have included this information as it was very easy to download the leaflets within the app.
Both	b4	FREE 2 B ME	1	Unknown	2	2	1	2	2	NHS branded app. Vaguely mentions condoms are only method of preventing STIs. STIs described generally specifically mentioned in examples only. Diagnostic tests not expanded further than swabs and urine tests. No management. 'Without treatment, some STIs such as Chlamydia, HIV, Herpes, HPV and Hepatitis may stop you having a baby naturally' 'Most STIs can be treated easily with medicine. But, you should always use a condom as some STIs such as HIV, Herpes, HPV and Hepatitis have no cure, and if the symptoms are left untreated could cause infertility'
Both	b5	Get Them Tested	1	Unknown	1	1	2	2	1	Unable to access partner notification module unless you have attended their clinic. Incorrectly states HPV is bloodborne
Both	b6	Kent C Card	2	99	99	99	99	99	2	Cites 'is your wee dark, or does it smell bad?' as a reason to get tested for STIs. Doesn't mention asymptomatic infection. Location of clinic services, condom dispensers. Contact information of services.
Both	b7	KIS-SK	2	99	99	99	99	99	2	Doesn't mention copper coil role in EC. Doesn't mention IUS. % quoted aren't accurate. Questions/answers on contraception & safe sex. Clinic finder for contraception & STIs. States OCP is taken everyday, no mention of 7 day break. States patch worn for 7 day, replaced weekly. Success rates of some contraceptive methods are much lower than those stated in NHS choices
Both	b8	KYSH - Know Your Sexual Health	2	99	99	99	99	99	2	Descriptions of STIs basic eg few example symptoms. Only mentions antivirals for herpes, no management for other STIs. No mention of avoiding STI, use of condom, safe sex. General info on tests - bloods, swabs, urine.
Both	b9	My Sex Doctor	2	99	99	99	99	99	2	Drug management is not specifically named, simply as antibiotics. Description of NGU: 'Acronym for nongonococcal urethritis, an infection caused by bacteria. The areas primarily affected by NGU are the cervix and the urethra. Typical symptoms are discharge from the penis or vagina and a burning sensation during urination. The infection can be sexually transmitted'
Both	b10	NeedTayKnow	2	99	99	99	99	99	2	Specific treatment names not mentioned; only antibiotics, antivirals, cream. Does not mention cervical cancer risk of HPV. No mention of how often to get tested. Diagnostic tests not explained further than generalised 'pee in a pot', swabs and blood.
Both	b11	SexPositive	2	99	99	99	99	99	2	Link from herpes page doesn't work. Information on chlamydia inaccurate and scaremongering. Risk tool not accurate. STD description included transmission, symptoms and complications. Nothing on diagnosis or management. Doesn't specify how often you should get STD check.
Both	b12	Sexual Health Guide	2	99	99	99	99	99	2	Diagnostic tests mentioned as swabs, bloods or urine sample. Treatments mentioned only as antibiotics, antivirals, creams etc. Sources listed at end. Extensive list of contraceptives, dis/advantages, contraindications, success rates, MoA
Both	b13	Sexual Health Liverpool	2	99	99	99	99	99	2	Brief sentence each for different types of contraception. Very extensive list of available sexual health services. Does not mention what happens in STI testing, diagnostic tests or management of STIs. Briefly mentions chlamydia.
Both	b14	Your rapid diagnosis STD	4	99	99	99	99	99	2	No specific information on CT despite being the commonest STI. Drug managements are not specific to UK; dosage, routes, first-line etc incorrect. Incorrectly states warts are caused by HPV 1, Gardasil vaccine protects against HPV1 (not 11) and is approved for use in girls 9-26. Vaccine 100% effective in preventing infection with HPV types 16,18, 1 & 6. Herpetic urethritis occurs in 30-40% of affected men. Re candida vulvovaginitis: 'although transmission is thought to be mainly sexual, non-sexual infection can also occur'. Yeast may be visualised directly under the microscope using a KOH preparation'; 'ensure partner is treated to prevent reinfection'. Re NSU: 'Treatment should cover NG as this organism is present in about 50% of cases. ELISA test for CT. When doing the risk assessment, chlamydia doesn't come up as an option.
Both	b15	Your Choice Your Voice (YCVV)	4	99	99	99	99	99	2	The app links to a web application that provides people with more information on STIs and contraception. Able to join C card and order a chlamydia test online. BV, thrush and NSU are all discussed under the same section together e.g. 'If left untreated they can cause reduced fertility, inflammation of the joints, urethra and eyes, long-term pelvic pain, ectopic (outside the womb) pregnancy, blocked fallopian tubes, testicle and prostate infection'. Re HSV: 'This is called asymptomatic shedding or viral shedding and is extremely contagious'

The following pages contain summary tables.

Table 18: Summary of basic details

	iOS n=20 (%)	Android n=52 (%)	Both n=15 (%)	Total n=87 (%)
Country of origin				
Australia	0	0	1 (7)	1 (1)
Canada	0	0	1 (7)	1 (1)
Denmark	1 (5)	0	0	1 (1)
Ireland	0	0	1 (7)	1 (1)
Malaysia	0	1 (2)	0	1 (1)
Singapore	0	0	1 (7)	1 (1)
Sweden	1 (5)	0	0	1 (1)
Uganda	0	1 (2)	0	1 (1)
UK	3 (15)	4 (8)	10 (67)	17 (20)
US	6 (30)	1 (2)	1 (7)	8 (9)
Unknown	9 (45)	45 (87)	0	54 (62)
Ratings				
Unrated	19 (95)	27 (52)	1 (7)	47 (54)
0 stars	0	0	1 (7)	1 (1)
1 star	0	1 (2)	0	1 (1)
2 stars	0	0	0	0
3 stars	0	3 (6)	0	3 (3)
4 stars	1 (5)	11 (21)	7 (47)	19 (22)
5 stars	0	7 (14)	6 (40)	13 (15)
Theme				
Books	1 (5)	6 (12)	0	7 (8)
Education	2 (10)	1 (2)	2 (13)	5 (6)
Health & Fitness	10 (50)	25 (48)	7 (47)	42 (48)
Lifestyle	2 (10)	4 (8)	2 (13)	8 (9)
Medical	5 (25)	16 (31)	4 (27)	25 (29)
Price				
Free	12 (60)	43 (83)	14 (93)	69 (79)
Paid	8 (40)	9 (17)	1 (7)	18 (21)
£0.00-£0.99	2 (10)	4 (8)	0	6 (7)
£1.00-	6 (30)	5 (10)	1 (7)	12 (14)

NB: for the apps that were available in both platforms, where different results were available for the individual platform (e.g. theme) I had to make an arbitrary decision as to which set of results to use. I chose to use the results for the Android version rather than iOS.

Table 18 continued

	iOS n=20 (%)	Android n= 52 (%)	Both n=15 (%)	Total n=87 (%)
Updated since Sept 2013				
Yes	6 (30)	35 (67)	3 (20)	44 (51)
No	14 (70)	17 (33)	12 (80)	43 (49)
Target audience				
General public	14 (70)	43 (83)	3 (20)	60 (69)
People with STI/infection	1 (5)	1 (2)	2 (13.3)	4 (5)
Parents	1 (5)	0	0	1 (1)
Other	4 (20)	8 (15)	10 (67)	22 (25)
App allows interaction with a HCP				
Yes	5 (25)	3 (6)	3 (20)	11 (13)
No	15 (75)	49 (94)	12 (80)	66 (87)
Type of HCP	<i>(n=5)</i>	<i>(n=3)</i>	<i>(n=3)</i>	<i>(n=11)</i>
Doctor	1 (20)	1 (33)	0	2 (18)
Unknown	4 (80)	2 (67)	3 (100)	8 (82)
Method of contact with HCP	<i>(n=5)</i>	<i>(n=4)</i>	<i>(n=3)</i>	<i>(n=12)</i>
Email	4 (80)	1 (25)	1 (33)	6 (50)
Phone	2 (40)	3 (75)	2 (67)	7 (58)
App	3 (60)	1 (25)	1 (33)	5 (42)
Upload photo	1 (20)	0	0	1 (8)
Able to share info with sexual partners				
Yes	0	1 (2)	1 (7)	2 (2)
No	20 (100)	51 (98)	14 (93)	85 (98)

Table 19: Age restriction for different platforms

Age restriction	iOS n=20 (%)	Android n= 52 (%)	Both n=15 (%)	Total (%)
iOS and Android				(n=87)
No age restriction	0	24 (46)	1 (7)	25 (28.7)
iOS				(n=35)
4+	2 (10)	-	2 (13)	5 (14)
9+	2 (10)	-	0	2 (6)
12+	7 (35)	-	10 (67)	17 (49)
17+	9 (45)	-	2 (13)	11 (31)
Android				(n=42)
Low maturity	-	10 (19)	2 (13)	12 (29)
Medium maturity	-	13 (25)	8 (53)	21 (50)
High maturity	-	5 (10)	4 (27)	9 (21)

Table 20: Comparison of age restriction for apps available on both platforms

Android age restriction	iOS age restriction			Total
	4+	12+	17+	
Everyone	0	0	1	1
Low maturity	2	0	0	2
Medium maturity	0	7	1	8
High maturity	0	3	1	4
Total	2	10	3	15

5.2 ADAPTED HON CRITERIA

Tables 21, 22 and 23 describe to what extent each app meets each criterion and whether the app is approved by NHS choices. A search of the NHS Choices Health Apps Library found 10 apps under the Sexual Health section. Four of these are targeted at patients with HIV, including information on contraception and drug adherence, one is aimed at helping people find out where they can get tested for HIV, and one is classified as 'alcohol'. Of the four apps related to sexual health, two have been downloaded and analysed in this review (My Sex Doctor and Kent C Card), one was excluded ((Well Happy) see Appendix I), and one was not found using the search terms applied (Freetest.me)(210).

Table 24 summarises the data by each criterion. 30% (26/87) of apps have a named author with only three (3%) apps and two (2%) apps having the author's training and qualification stated respectively. Whereas a larger proportion of Android apps clearly stated that the information provided was supportive and not a replacement for clinical care, a far higher proportion of iOS apps and apps available in both platforms had the app mission, purpose and audience stated. Only 18% (16/87) of apps provided details on the organisation behind the app. Information on the privacy policy was unavailable for the majority of apps with only three (3%) apps addressing this. Likewise, only three (3%) apps had any sort of referencing and dating of the documentation and only four apps (5%) backed claims with scientific evidence, and these were all only assessed as being partially complete. No apps displayed the medical content date of creation and modification.

84% (73/87) of apps were assessed as having correct grammar and spelling. However, this varied depending on app platform with 93% (14/15) of apps available in both platforms, 90% (18/20) of iOS apps and 79% (41/52) of Android apps having correct spelling and grammar. In 89% (77/87) of the apps, the information was deemed to be accessible and clearly stated.

Again this varied according to platform with 85% (17/20) of iOS apps, 94% (49/52) of Android apps and 73% (11/15) of apps available in both platforms meeting this criterion. 97% (85/87) were operational.

Whereas 90% (47/52) of Android apps had a method of contacting the app publisher within the app description provided in the Googleplay store, only 40% (8/20) of iOS apps and 60% (9/15) of apps available in both platforms provided this information. Very few (4/87 (5%)) apps had information on the source of funding for the app. Only one app (1%) addressed conflicts of interest and external influences within a disclaimer, and only one (3%) app out of the 34 with paying banners provided an advertising policy.

When looking at the number of HON criteria met by each app stratified by platform (see Tables 25 and 26), it can be seen that overall the apps met a median of 4 (IQR 2; 21%) of the 19 criteria. Both iOS (median = 5; IQR 3) and apps that were available on both platforms (median =5; IQR 2) met more criteria than Android apps (median = 4; IQR 1.5). 71% (62/87) of apps met five or less criteria, 28% (24/87) met between 6 and 10, and only 1% (1/87) met between 11 and 15. No apps met more than 11 criteria.

Table 21: Adapted HON criteria (iOS only)

Platform	App ID	Title of App	Author named	Training stated	Qualification clearly stated	Clearly stated that info is supportive and not a replacement	App mission, purpose & audience stated	Organisation behind app described, incl purpose & mission	Privacy policy incl info on how emails are managed if used	Documented, referenced & dated	Medical content date of creation present	Medical content date of modification present	Grammar & spelling correct	All claims backed up with scientific evidence	App operational	Information accessible & clearly stated	Method of contacting app publisher	Source/s of funding stated	Conflicts of interest & external influences clearly stated in disclaimer	Those with paying banners have advertising policy	Any conflict of interest explained	No of HON criteria met	Approved by NHS choices
iOS	i1	Sexually transmitted disease (STD) triage	Yes	Yes	No	Yes	Yes	Yes	Yes	No	No	No	Yes	No	Yes	Yes	Yes	Yes	No	N/A	N/A	11	No
iOS	i2	STD Guide	No	No	No	Yes	Yes	No	No	No	No	No	No	No	Yes	Yes	No	No	No	N/A	N/A	4	No
iOS	i3	STD Glossary	No	No	No	No	Partial	No	No	No	No	No	Yes	No	Yes	Yes	No	No	No	N/A	N/A	3	No
iOS	i4	iCondom Coventry	No	No	No	Partial	Yes	Yes	Partial	No	No	No	Yes	No	Yes	Yes	Yes	Yes	No	N/A	N/A	7	No
iOS	i5	99 - The Talk	Yes	Yes	Yes	No	Yes	Yes	No	No	No	No	Yes	No	Yes	Yes	Yes	N/A	N/A	N/A	N/A	9	No
iOS	i6	Safer Sex	Yes	No	No	No	No	No	No	No	No	No	Yes	No	Yes	Yes	No	No	N/A	N/A	N/A	4	No
iOS	i7	STD411	Yes	No	No	No	Yes	Yes	No	No	No	No	Yes	No	Yes	Yes	Yes	No	No	N/A	N/A	7	No
iOS	i8	Private Girl Tips	Yes	Yes	Yes	No	Yes	No	No	No	No	No	Yes	No	Yes	No	No	No	No	No	N/A	6	No
iOS	i9	SWISH APP	No	No	No	No	Yes	Yes	No	No	No	No	Yes	No	Yes	Yes	No	No	No	N/A	N/A	5	No
iOS	i10	Sex Health Dictionary & Sexual Health Video Lessons	No	No	No	No	No	No	No	No	No	No	Yes	No	Yes	Yes	No	No	No	No	N/A	3	No
iOS	i11	Safesex Guide	No	No	No	No	No	No	No	No	No	No	No	No	Yes	No	Yes	No	No	N/A	N/A	2	No
iOS	i12	Safe sex	No	No	No	No	No	No	No	No	No	No	Yes	No	Yes	Yes	No	No	No	N/A	N/A	3	No
iOS	i13	SafeSex101	No	No	No	No	No	No	No	No	No	No	Yes	No	No	No	No	No	No	N/A	N/A	1	No
iOS	i14	SAFE - Safety Awareness for Everyone	Yes	No	No	No	No	No	No	No	No	No	Yes	No	Yes	Yes	No	No	No	N/A	N/A	4	No
iOS	i15	iSex - Sex Education and Terminology	Yes	No	No	No	Yes	No	No	No	No	No	Yes	No	Yes	Yes	No	No	No	No	N/A	5	No
iOS	i16	Girls's guide for sex myths	No	No	No	No	Partial	No	No	No	No	No	Yes	No	Yes	Yes	Yes	No	No	N/A	N/A	4	No
iOS	i17	CaSH 2 U	Yes	No	No	No	No	Partial	No	No	No	No	Yes	No	Yes	Yes	Yes	No	No	N/A	N/A	5	No
iOS	i18	Pap Test Lite	No	No	No	Yes	Yes	No	Yes	No	No	No	Yes	No	Yes	Yes	No	No	No	N/A	No	6	No
iOS	i19	Natural Yeast Infection Solutions	No	No	No	Yes	Yes	Yes	No	No	No	No	Yes	No	Yes	Yes	Yes	No	No	N/A	N/A	7	No
iOS	i20	A woman's guide to yeast infections	No	No	No	Yes	Yes	No	No	No	No	No	Yes	No	Yes	Yes	No	No	No	N/A	N/A	5	No

Table 22: Adapted HON criteria (Android only)

Platform	App ID	Title of App	Author named	Training stated	Qualification clearly stated	Clearly stated that info is supportive and not a replacement	App mission, purpose & audience stated	Organisation behind app described, incl purpose & mission	Privacy policy incl info on how emails are managed if used	Documented, referenced & dated	Medical content date of creation present	Medical content date of modification present	Grammar & spelling correct	All claims backed up with scientific evidence	App operational	Information accessible & clearly stated	Method of contacting app publisher	Source/s of funding stated	Conflicts of interest & external influences clearly stated in disclaimer	Those with paying banners have advertising policy	Any conflict of interest explained	No of HON criteria met	Approved by NHS choices
Android	a1	Abnormal Vaginal Discharge	No	No	No	Absent	Partially	Absent	Absent	Absent	No	No	No	Absent	Yes	Yes	No	No	No	N/A	N/A	2	No
Android	a2	About Herpes Simplex Infection	Yes	No	No	Completely	Partially	Partially	Absent	Absent	No	No	No	Absent	Yes	Yes	No	No	No	N/A	N/A	4	No
Android	a3	After Sex	No	No	No	Absent	Partially	Absent	Absent	Absent	No	No	Yes	Absent	Yes	Yes	No	No	No	N/A	N/A	3	No
Android	a4	Bacterial Vaginosis Disease	Yes	No	No	Partially	Partially	Absent	Absent	Absent	No	No	Yes	Absent	Yes	Yes	Yes	No	No	No	N/A	5	No
Android	a5	Bacterial Vaginosis Guide	Yes	No	No	Completely	Partially	Absent	Absent	Absent	No	No	Yes	Absent	Yes	Yes	Yes	No	No	N/A	N/A	6	No
Android	a6	Bacterial Vaginosis Treatments	No	No	No	Partially	Partially	Absent	Absent	Absent	No	No	Yes	Absent	Yes	Yes	Yes	No	No	No	N/A	4	No
Android	a7	Chlamydia Disease and Symptoms	Yes	No	No	Completely	Completely	Absent	Absent	Absent	No	No	Yes	Absent	Yes	Yes	Yes	No	No	No	N/A	6	No
Android	a8	Chlamydia Know it Prevent it Treat it	No	No	No	Absent	Absent	Absent	Absent	Absent	No	No	No	Absent	Yes	Yes	No	No	No	No	No	2	No
Android	a9	Deadly Herpes Virus Acyclovir	No	No	No	Absent	Absent	Absent	Absent	Absent	No	No	Yes	Absent	Yes	Yes	No	No	No	N/A	N/A	3	No
Android	a10	Female Herpes	No	No	No	Completely	Absent	Absent	Absent	Absent	No	No	Yes	Absent	Yes	Yes	Yes	No	No	No	No	5	No
Android	a11	Genital herpes guide	No	No	No	Completely	Absent	Absent	Absent	Absent	No	No	No	Absent	Yes	Yes	Yes	No	No	N/A	N/A	4	No
Android	a12	Genital Herpes Information	Yes	No	No	Completely	Partially	Absent	Absent	Absent	No	No	Yes	Absent	Yes	Yes	Yes	No	No	No	N/A	6	No
Android	a13	Genital Herpes Treatment	No	No	No	Completely	Absent	Absent	Absent	Absent	No	No	No	Absent	Yes	Yes	Yes	No	No	N/A	N/A	4	No
Android	a14	Genital Herpes Treatment	No	No	No	Completely	Absent	Absent	Absent	Absent	No	No	No	Absent	Yes	Yes	Yes	No	No	No	N/A	4	No
Android	a15	Genital Warts Guide	No	No	No	Completely	Absent	Absent	Absent	Absent	No	No	No	Absent	Yes	Yes	Yes	No	No	No	N/A	4	No
Android	a16	Genital Warts Guide	No	No	No	Completely	Absent	Absent	Absent	Absent	No	No	No	Absent	Yes	Yes	Yes	No	No	No	N/A	4	No
Android	a17	Genital warts info	No	No	No	Absent	Absent	Absent	Absent	Absent	No	No	Yes	Absent	Yes	Yes	Yes	No	No	No	N/A	4	No

Table 22 continued

Platform	App ID	Title of App	Author named	Training stated	Qualification clearly stated	Clearly stated that info is supportive and not a replacement	App mission, purpose & audience stated	Organisation behind app described, incl purpose & mission	Privacy policy incl info on how emails are managed if used	Documented, referenced & dated	Medical content date of creation present	Medical content date of modification present	Grammar & spelling correct	All claims backed up with scientific evidence	App operational	Information accessible & clearly stated	Method of contacting app publisher	Source/s of funding stated	Conflicts of interest & external influences clearly stated in disclaimer	Those with paying banners have advertising policy	Any conflict of interest explained	No of HON criteria met	Approved by NHS choices
Android	a18	Genital Warts Info	No	No	No	Absent	Absent	Absent	Absent	Absent	No	No	Yes	Absent	Yes	Yes	Yes	No	No	No	N/A	4	No
Android	a19	Genital Warts Info	No	No	No	Absent	Absent	Absent	Absent	Absent	No	No	No	Absent	Yes	Yes	Yes	No	No	No	N/A	3	No
Android	a20	Genital Warts Information	Yes	No	No	Completely	Partially	Absent	Absent	Absent	No	No	Yes	Absent	Yes	Yes	Yes	No	No	N/A	N/A	6	No
Android	a21	Get Rid of Bacterial Vaginosis	Yes	No	No	Absent	Partially	Absent	Absent	Absent	No	No	Yes	Absent	Yes	No	Yes	No	No	No	N/A	4	No
Android	a22	Get Rid of Yeast Infection Now !	No	No	No	Absent	Absent	Absent	Absent	Absent	No	No	Yes	Absent	Yes	Yes	Yes	No	No	No	N/A	4	No
Android	a23	Gonorrhea Disease & Symptoms	Yes	No	No	Completely	Partially	Absent	Absent	Absent	No	No	Yes	Absent	Yes	Yes	Yes	No	No	N/A	N/A	6	No
Android	a24	Guide to STDs	No	No	No	Completely	Partially	Absent	Absent	Absent	No	No	Yes	Absent	Yes	Yes	Yes	No	No	N/A	No	5	No
Android	a25	Herpes Knowledge	No	No	No	Absent	Absent	Absent	Absent	Absent	No	No	Yes	Absent	Yes	Yes	Yes	No	No	No	N/A	4	No
Android	a26	Herpes Lupus Psoriasis Eczema	Yes	No	No	Absent	Partially	Absent	Absent	Absent	No	No	No	Absent	Yes	Yes	Yes	No	No	No	N/A	4	No
Android	a27	Herpes Treatment	No	No	No	Absent	Partially	Absent	Absent	Absent	No	No	Yes	Absent	Yes	Yes	Yes	No	No	No	N/A	4	No
Android	a28	HPV Infection Information	Yes	No	No	Completely	Partially	Absent	Absent	Absent	No	No	Yes	Absent	Yes	Yes	Yes	No	No	N/A	N/A	6	No
Android	a29	iGirl	No	No	No	Absent	Partially	Absent	Absent	Absent	No	No	Yes	Absent	Yes	Yes	Yes	No	No	N/A	N/A	4	No
Android	a30	Knowledge of Herpes	No	No	No	Absent	Absent	Absent	Absent	Absent	No	No	Yes	Absent	Yes	Yes	Yes	No	No	No	N/A	4	No
Android	a31	No Worries	Yes	No	No	Absent	Partially	Absent	Absent	Absent	No	No	Yes	Absent	Yes	Yes	Yes	No	No	N/A	N/A	5	No
Android	a32	NORISKS	No	No	No	Absent	Completely	Absent	Absent	Absent	No	No	Yes	Absent	Yes	No	Yes	No	No	N/A	N/A	4	No
Android	a33	Painful urination in men	No	No	No	Completely	Partially	Absent	Absent	Absent	No	No	Yes	Absent	No	Yes	Yes	No	No	N/A	N/A	4	No
Android	a34	Pelvic inflammatory disease	Yes	No	No	Completely	Completely	Absent	Absent	Absent	No	No	Yes	Absent	Yes	Yes	Yes	No	No	N/A	N/A	7	No

Table 22 continued

Platform	App ID	Title of App	Author named	Training stated	Qualification clearly stated	Clearly stated that info is supportive and not a replacement	App mission, purpose & audience stated	Organisation behind app described, incl purpose & mission	Privacy policy incl info on how emails are managed if used	Documented, referenced & dated	Medical content date of creation present	Medical content date of modification present	Grammar & spelling correct	All claims backed up with scientific evidence	App operational	Information accessible & clearly stated	Method of contacting app publisher	Source/s of funding stated	Conflicts of interest & external influences clearly stated in disclaimer	Those with paying banners have advertising policy	Any conflict of interest explained	No of HON criteria met	Approved by NHS choices
Android	a35	Protection - Sex	No	No	No	Absent	Completely	Partially	Absent	Partially	No	No	Yes	Partially	Yes	Yes	Yes	No	No	N/A	N/A	5	No
Android	a36	Pubic Lice Crabs Information	Yes	No	No	Completely	Partially	Absent	Absent	Absent	No	No	Yes	Absent	Yes	Yes	Yes	No	No	No	N/A	6	No
Android	a37	SAFE	No	No	No	Absent	Partially	Absent	Absent	Absent	No	No	Yes	Absent	Yes	Yes	Yes	No	No	N/A	N/A	4	No
Android	a38	Safer sex	No	No	No	Absent	Completely	Partially	Absent	Partially	No	No	Yes	Partially	Yes	Yes	Yes	No	No	N/A	N/A	5	No
Android	a39	Samedaydoctor - STD Testing	No	No	No	Absent	Partially	Partially	Absent	Absent	No	No	Yes	Absent	Yes	Yes	Yes	No	No	N/A	N/A	4	No
Android	a40	Sexual Education	No	No	No	Absent	Partially	Absent	Absent	Absent	No	No	Yes	Absent	Yes	Yes	Yes	No	No	N/A	N/A	4	No
Android	a41	Sexually transmitted Stds	Yes	No	No	Completely	Completely	Partially	Absent	Absent	No	No	Yes	Absent	Yes	Yes	Yes	No	No	No	N/A	7	No
Android	a42	Sheffield SH	No	No	No	Absent	Completely	Completely	Absent	Absent	No	No	Yes	Absent	Yes	Yes	Yes	Yes	Yes	N/A	No	8	No
Android	a43	STD glossary	No	No	No	Absent	Partially	Absent	Absent	Absent	No	No	Yes	Absent	Yes	Yes	Yes	No	No	N/A	N/A	4	No
Android	a44	Stop Vaginal Odor	No	No	No	Absent	Partially	Absent	Absent	Absent	No	No	Yes	Absent	Yes	Yes	Yes	No	No	No	N/A	4	No
Android	a45	Syphilis Disease and Symptoms	Yes	No	No	Completely	Completely	Absent	Absent	Absent	No	No	No	Absent	Yes	Yes	Yes	No	No	No	No	6	No
Android	a46	The Big Book - Symptoms of STD	No	No	No	Partially	Completely	Absent	Absent	Absent	No	No	Yes	Absent	Yes	Yes	Yes	No	No	No	N/A	5	No
Android	a47	The Sex Guide	No	No	No	Absent	Completely	Partially	Absent	Absent	No	No	Yes	Absent	Yes	Yes	Yes	No	No	N/A	N/A	5	No
Android	a48	Treat Genital Herpes Naturally	No	No	No	Absent	Partially	Absent	Absent	Absent	No	No	Yes	Absent	Yes	Yes	Yes	No	No	No	N/A	4	No
Android	a49	Trichomoniasis information	Yes	No	No	Completely	Completely	Absent	Absent	Absent	No	No	Yes	Absent	Yes	Yes	Yes	No	No	N/A	N/A	7	No
Android	a50	UCT Safe Sex	Yes	No	No	Absent	Absent	Completely	Absent	Absent	No	No	Yes	Absent	Yes	Yes	Yes	No	No	N/A	N/A	6	No
Android	a51	Yeast Infection	No	No	No	Absent	Partially	Absent	Absent	Absent	No	No	Yes	Absent	Yes	No	Yes	No	No	No	N/A	3	No
Android	a52	Yeast Infection Home Remedy	Yes	No	No	Partially	Partially	Absent	Absent	Absent	No	No	Yes	Absent	Yes	Yes	Yes	No	No	No	N/A	5	No

Table 23: Adapted HON criteria (apps available in both platforms)

Platform	App ID	Title of App	Author named	Training stated	Qualification clearly stated	Clearly stated that info is supportive and not a replacement	App mission, purpose & audience stated	Organisation behind app described, incl purpose & mission	Privacy policy incl info on how emails are managed if used	Documented, referenced & dated	Medical content date of creation present	Medical content date of modification present	Grammar & spelling correct	All claims backed up with scientific evidence	App operational	Information accessible & clearly stated	Method of contacting app publisher	Source/s of funding stated	Conflicts of interest & external influences clearly stated in disclaimer	Those with paying banners have advertising policy	Any conflict of interest explained	No of HON criteria met	Approved by NHS choices
Both	b1	C&SH Somerset	No	No	No	Absent	Absent	Completely	Absent	Absent	No	No	Yes	Absent	Yes	Yes	No	No	No	Not applicable	Not applicable	4	No
Both	b2	Conifer Sex Health	No	No	No	Partially	Completely	Partially	Absent	Absent	No	No	Yes	Absent	Yes	Yes	Yes	No	No	Not applicable	Not applicable	5	No
Both	b3	FPA - Find a Clinic	No	No	No	Partially	Completely	Completely	Absent	Absent	No	No	Yes	Partially	Yes	Yes	Yes	No	Not applicable	Not applicable	Not applicable	6	No
Both	b4	FREE 2 B ME	No	No	No	Absent	Completely	Partially	Absent	Absent	No	No	Yes	Absent	Yes	Yes	No	No	No	Not applicable	Not applicable	4	No
Both	b5	Get Them Tested	No	No	No	Completely	Completely	Completely	Partially	Absent	No	No	Yes	Absent	Yes	Yes	Yes	No	No	Not applicable	Not applicable	7	No
Both	b6	Kent C Card	No	No	No	Absent	Completely	Completely	Absent	Absent	No	No	Yes	Absent	Yes	No	No	No	No	Not applicable	Not applicable	4	Yes
Both	b7	KIS-SK	No	No	No	Completely	Completely	Partially	Partially	Absent	No	No	Yes	Absent	Yes	Yes	No	No	No	Not applicable	Not applicable	5	No
Both	b8	KYSH - Know Your Sexual Health	No	No	No	Absent	Completely	Partially	Absent	Absent	No	No	Yes	Absent	Yes	Yes	Yes	No	No	Not applicable	Not applicable	5	No
Both	b9	My Sex Doctor	No	No	No	Completely	Completely	Completely	Completely	Partially	No	No	Yes	Partially	Yes	Yes	Yes	No	Not applicable	Yes	Not applicable	9	Yes
Both	b10	NeedTayKnow	No	No	No	Absent	Completely	Completely	Absent	Absent	No	No	Yes	Absent	Yes	No	No	No	No	Not applicable	Not applicable	4	No
Both	b11	SexPositive	No	No	No	Absent	Completely	Completely	Partially	Absent	No	No	Yes	Absent	Yes	Yes	Yes	Yes	Not applicable	Not applicable	Not applicable	7	No
Both	b12	Sexual Health Guide	No	No	No	Absent	Partially	Partially	Absent	Absent	No	No	No	Absent	Yes	Yes	Yes	No	No	Not applicable	Not applicable	3	No
Both	b13	Sexual Health Liverpool	No	No	No	Absent	Absent	Partially	Absent	Absent	No	No	Yes	Absent	Yes	No	Yes	No	No	Not applicable	Not applicable	3	No
Both	b14	Your rapid diagnosis STD	No	No	No	Completely	Completely	Completely	Absent	Absent	No	No	Yes	Absent	Yes	No	Yes	No	No	Not applicable	Not applicable	6	No
Both	b15	Your Choice Your Voice (YCVV)	No	No	No	Absent	Completely	Partially	Absent	Absent	No	No	Yes	Absent	Yes	Yes	No	No	No	Not applicable	Not applicable	4	No

The following tables summarise the HON criteria:

Table 24: Summary of each HON criterion

	iOS n=20 (%)			Android n=52 (%)			Both n=15 (%)			Total n=87 (%)		
	Yes	Partially	No	Yes	Partially	No	Yes	Partially	No	Yes	Partially	No
Author named (%)	8 (40)	-	12 (60)	18 (35)	-	34 (65)	0	-	15 (100)	26 (30)	-	61 (70)
Training stated (%)	3 (15)	-	17 (85)	0	-	52 (100)	0	-	15 (100)	3 (3)	-	2 (84)
Qualification clearly stated (%)	2 (10)	-	18 (90)	0	-	52 (100)	0	-	15 (100)	2 (2)	-	85 (98)
Clearly stated information supportive & not replacement (%)	5 (25)	1 (5)	14 (70)	20 (38)	4 (8)	28 (54)	4 (27)	2 (13)	9 (60)	29 (33)	7 (8)	51 (59)
App mission, purpose & audience stated (%)	10 (52.6)	2 (10.5)	7 (36.8)	11 (21)	26 (50)	25 (29)	12 (80)	1 (7)	2 (13)	34 (39)	29 (33)	24 (28)
Organisation behind app described, including purpose & mission (%)	6 (30)	1 (5)	13 (65)	2 (4)	6 (12)	44 (85)	8 (53)	-	7 (47)	16 (18)	14 (16)	57 (66)
Privacy policy including information on how emails are managed if used (%)	2 (10)	1 (5)	17 (85)	0	0	52 (100)	1 (7)	3 (20)	11 (73)	3 (3)	4 (5)	80 (92)
Documented, referenced & dated (%)	0	0	20 (100)	0	2 (4)	50 (96)	0	1 (7)	14 (93)	0	3 (3)	84 (97)
Medical content date of creation present (%)	0	-	20 (100)	0	-	52 (100)	0	-	52 (100)	0	-	87 (100)
Medical content date of modification present (%)	0	-	20 (100)	0	-	52 (100)	0	-	52 (100)	0	-	87 (100)
Grammar & spelling correct (%)	18 (90)	-	2 (10)	41 (79)	-	11 (21)	14 (93)	-	1 (7)	73 (84)	-	14 (16)

Table 24 continued

	iOS n=20 (%)				Android n=52 (%)				Both n=15 (%)				Total n=87 (%)			
	Yes	Partially	No	Not applicable	Yes	Partially	No	Not applicable	Yes	Partially	No	Not applicable	Yes	Partially	No	Not applicable
All claims backed up with scientific evidence	0	0	20 (100)	-	0	2 (4)	50 (96)	-	0	2 (13)	13 (87)	-	0	4 (5)	83 (95)	-
App operational	19 (95)	-	1 (5)	-	51 (98)	-	1 (2)	-	15 (100)	-	0	-	85 (97)	-	2 (2)	-
Information accessible & clearly stated	17 (85)	-	3 (15)	-	49 (94)	-	3 (6)	-	11 (73)	-	4 (27)	-	77 (89)	-	10 (11)	-
Method of contacting app publisher	8 (40)	-	12 (60)	-	47 (90)	-	5 (10)	-	9 (60)	-	6 (40)	-	64 (74)	-	23 (26)	-
Source/s of funding stated	2 (10)	-	18 (90)	0	1 (2)	-	51 (98)	0	1 (7)	-	14 (93)	0	4 (5)	-	83 (95)	0
Conflicts of interest & external influences clearly stated in disclaimer	0	-	19 (95)	1 (5)	1 (2)	-	51 (98)	0	0	-	12 (80)	3 (20)	1 (1)	-	82 (94)	4 (5)
Those with paying banners have advertising policy	0	-	3 (15)	17 (85)	0	-	26 (50)	26 (50)	1 (7)	-	0	14 (93)	1 (1)	-	29 (33)	57 (66)
Any conflict of interest explained	0	-	1 (5)	19 (15)	0	-	5 (10)	47 (90)	0	-	0	15 (100)	0	-	6 (7)	81 (93)
Approved by NHS choices	0	-	20 (100)	-	0	-	52 (100)	-	2 (13)	-	13 (87)	-	2 (2)	-	85 (98)	-

Table 25: Summary of number of HON criteria met according to app platform

No of HON criteria met (n=19)	iOS (%) n=20	Android (%) n=52	Both (%) n=15	Total (%) n=87
2	1 (5)	2 (4)	0	3 (3)
3	3 (15)	4 (8)	2 (13)	9 (10)
4	4 (20)	24 (46)	5 (33)	33 (38)
5	4 (20)	9 (17)	3 (20)	16 (18)
6	2(10)	9 (17)	2 (13)	13 (15)
7	3 (15)	3 (6)	2 (13)	8 (9)
8	0	1 (2)	0	1 (1)
9	1(5)	0	1 (7)	2 (2)
10	0	0	0	0
11	1(5)	0	0	1 (1)
Median (IQR)	5 (3)	4 (1.5)	5 (2)	4 (2)

Table 26: Summary of number of HON criteria met according to app platform divided into strata

No of HON criteria met	iOS (%) n=20	Android (%) n=52	Both (%) n=15	Total (%) n=87
0-5	13 (65)	39 (75)	10 (67)	62 (71)
6-10	6 (30)	13 (25)	5 (33)	24 (28)
11-15	1 (5)	0	0	1 (1)
16-19	0	0	0	0

5.3 COMPREHENSIVENESS OF APPS

As described on page 53, the FPA, NHS Choices and BASHH patient information webpages provide comprehensive coverage of all elements of routine STI/genital infection management. In contrast, we found great variability in coverage and comprehensiveness of these elements in the apps reviewed.

I will first describe the coverage and comprehensiveness of the content parameters (i.e. safe sex, testing, diagnosis, information about STIs/infection, management, partner notification, ePrescribing, contraception and service provision). I will then describe the coverage and comprehensiveness of the individual STI/infections (e.g. chlamydia, gonorrhoea).

Content parameters

Fully comprehensive coverage

A minority of apps provided fully comprehensive information on individual content parameters with an overall median of 1 (IQR 2) content parameter covered fully per app (median 1 (IQR1) for iOS apps; median 0 (IQR 1) for Android apps; median 2 (IQR 1) for apps available in both platforms) (see Table 34).

We found that there was marked variability depending on the parameter we were assessing and the platform the app was from (see Tables 27 to 33 below). Whereas 47% (13/15) of apps available in both platforms provided fully comprehensive information on safe sex, only 5% (1/20) of iOS apps did and only 10% (5/52) Android apps did. This pattern of a greater proportion of apps available in both platforms providing fully comprehensive information, compared to iOS apps and Android apps, was present in all areas of STI management to greater and lesser degrees.

Partially comprehensive coverage

A much higher proportion of apps provided partial information on the content parameters compared to providing fully comprehensive information, with the exception of service provision (24% (21/87) fully comprehensive; 10% (11/87) partially comprehensive). This was particularly striking with Android apps which provided fully comprehensive information on a median of 0 content parameters, and partially comprehensive information on a median of 4 (IQR 2) content parameters (see Table 35).

Overall coverage

A median of 5 (IQR 3) content parameters were covered per app, with iOS apps covering a median of 4 (IQR 4), Android apps covering a median of 5 (IQR 3) and apps available in both platforms covering a median of 6.5 (IQR 4). The wide IQR reflect the variability in terms of content parameters covered, with between 1 (n=4) and 8 (n=6) content parameters being covered per individual app (see Table 36).

Eighty nine percent (78/87) of apps provided information about STIs/infections (including about aetiology, pathogenesis, symptoms, prevention, transmission, and natural history where appropriate). However, the majority of apps (71% (62/87)) provided only partially comprehensive information.

Overall 21% failed to provide any information on safe sex and, of particular concern, 67% did not provide any information on partner notification. iOS apps were particularly poor at providing information on the latter with 80% (16/20) of apps providing no information.

Six percent (5/87) of apps solely focussed on accessing STI testing, although overall only 64% (54/87) of apps covered this parameter. No apps covered electronic prescribing. Although coverage of contraception was poor, particularly for iOS apps and apps available in both platforms, we only used one search term ('contraception') to search for this.

STI/genital infections

Fully comprehensive coverage

Only 18% (median 0 (IQR 0)) of apps provided fully comprehensive information on the STI/s or genital infection/s that they were covering (see Table 37). This equated to no more than 7 apps (8%) providing information for each STI/infection at this level of detail.

Coverage of STIs and provision of information did not reflect prevalence of STIs within the UK. Despite chlamydia being the commonest bacterial genital infection within the UK, with up to 10% of 16-24 year olds infected (211), only three apps (3%) provided fully comprehensive information. A higher proportion of apps (8% (7/87)) provided fully comprehensive information on gonorrhoea. Likewise, 8% (7/87) of apps provided fully comprehensive information on genital herpes, the most common infection covered overall.

Partially comprehensive coverage

As with coverage of content parameters, a much higher proportion of individual STI/genital infections were covered partially as opposed to fully (see Table 38). The condition that was covered most commonly was genital herpes, with 46% (40/87) providing partial information.

Overall coverage

Content coverage was highly variable with 34/87 (39%) covering one or two infections, 47% (16/34) of which were ebooks, predominantly about genital herpes or candidiasis. 46% (40/87) of apps covered three or more infections (see Table 39).

Fifty seven percent (50/87) of the eligible apps provided no information on chlamydia, There was wide variability of coverage when comparing iOS and Android apps with, for example, 55% (11/20) of iOS apps providing information on chlamydia compared with 27% (14/52) of Android apps. A higher proportion of iOS apps, compared to Android apps, provided information on all the different STIs/infections with the exception of bacterial vaginosis and

pelvic inflammatory disease. Bacterial vaginosis and vaginal candidiasis were covered in 22% (19/87) and 23% (26/87) of apps respectively.

As with areas of STI management, for the majority of STIs/infection, apps that were available in both platforms covered more STIs/infections and provided more comprehensive information compared with iOS apps and Android apps.

Table 27: Comprehensiveness of content type and STI/infection type for each app (iOS only)

Platform	App ID	Title of App	Safe sex	Testing	Diagnosis	Information about STIs/infection	Management	Partner notification	ePrescribing	Contraception	Service provision	Chlamydia	Gonorrhoea	Syphilis	Genital warts	HPV	Genital herpes	Pubic lice	Trichomonas vaginalis	Vaginal candidiasis	Bacterial vaginosis	NGU	Pelvic inflammatory disease	Epididymitis
iOS	i1	Sexually transmitted disease (STD) triage	Partial	Complete	Absent	Complete	Partial	Partial	Absent	Absent	Partial	Partial	Partial	Partial	Partial	Partial	Partial	Absent	Absent	Partial	Absent	Absent	Absent	Absent
iOS	i2	STD Guide	Partial	Partial	Partial	Partial	Partial	Partial	Absent	Absent	Partial	Complete	Complete	Complete	Complete	Complete	Complete	Absent	Complete	Absent	Absent	Absent	Absent	Absent
iOS	i3	STD Glossary	Partial	Partial	Partial	Partial	Absent	Complete	Absent	Partial	Absent	Partial	Partial	Partial	Partial	Partial	Partial	Partial	Partial	Partial	Absent	Partial	Partial	Absent
iOS	i4	iCondom Coventry	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Complete	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent
iOS	i5	99 - The Talk	Partial	Partial	Complete	Complete	Partial	Absent	Absent	Complete	Absent	Partial	Partial	Partial	Complete	Complete	Partial	Partial	Partial	Partial	Partial	Partial	Partial	Partial
iOS	i6	Safer Sex	Partial	Absent	Absent	Absent	Absent	Absent	Absent	Partial	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent
iOS	i7	STDPartial11	Partial	Partial	Absent	Partial	Absent	Absent	Absent	Partial	Complete	Partial	Partial	Partial	Absent	Absent	Partial	Absent	Absent	Absent	Absent	Absent	Absent	Absent
iOS	i8	Private Girl Tips	Partial	Partial	Absent	Partial	Partial	Partial	Absent	Absent	Absent	Partial	Partial	Partial	Partial	Partial	Partial	Partial	Partial	Partial	Absent	Absent	Absent	Absent
iOS	i9	SWISH APP	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Complete	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent
iOS	i10	Sex Health Dictionary & Sexual Health Video Lessons	Partial	Partial	Partial	Partial	Partial	Absent	Absent	Partial	Absent	Partial	Partial	Partial	Partial	Partial	Partial	Partial	Partial	Partial	Partial	Absent	Partial	Partial
iOS	i11	Safesex Guide	Partial	Absent	Absent	Partial	Partial	Absent	Absent	Partial	Absent	Partial	Partial	Partial	Partial	Partial	Partial	Partial	Partial	Partial	Absent	Partial	Absent	Absent
iOS	i12	Safe sex	Partial	Absent	Absent	Absent	Absent	Absent	Absent	Partial	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent
iOS	i13	SafeSex101	Partial	Complete	Partial	Partial	Partial	Absent	Absent	Partial	Complete	Partial	Partial	Partial	Partial	Partial	Partial	Partial	Partial	Absent	Absent	Absent	Absent	Absent
iOS	i14	SAFE - Safety Awareness for Everyone	Partial	Partial	Absent	Complete	Partial	Absent	Absent	Partial	Partial	Partial	Partial	Partial	Partial	Partial	Partial	Absent	Absent	Absent	Absent	Absent	Absent	Absent
iOS	i15	iSex - Sex Education and Terminology	Partial	Absent	Absent	Partial	Absent	Absent	Absent	Partial	Absent	Partial	Partial	Partial	Partial	Partial	Partial	Partial	Absent	Partial	Absent	Absent	Partial	Partial
iOS	i16	Girls's guide for sex myths	Complete	Absent	Absent	Partial	Absent	Absent	Absent	Partial	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent
iOS	i17	CaSH Complete U	Absent	Partial	Absent	Absent	Absent	Absent	Absent	Absent	Complete	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent
iOS	i18	Pap Test Lite	Absent	Partial	Partial	Partial	Absent	Absent	Absent	Absent	Partial	Absent	Absent	Absent	Absent	Partial	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent
iOS	i19	Natural Yeast Infection Solutions	Partial	Absent	Absent	Partial	Partial	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Complete	Absent	Absent	Absent	Absent
iOS	i20	A woman's guide to yeast infections	Partial	Absent	Partial	Partial	Complete	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Complete	Absent	Absent	Absent	Absent

Table 28: Comprehensiveness of content type and STI/infection type for each app (Android only)

Platform	App ID	Title of App	Safe sex	Testing	Diagnosis	Information about STIs/infection	Management	Partner notification	ePrescribing	Contraception	Service provision	Chlamydia	Gonorrhoea	Syphilis	Genital warts	HPV	Genital herpes	Pubic lice	Trichomonas vaginalis	Vaginal candidiasis	Bacterial vaginosis	NGU	Pelvic inflammatory disease	Epididymitis
Android	a1	Abnormal Vaginal Discharge	Partial	Absent	Absent	Partial	Partial	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Partial	Partial	Partial	Absent	Partial	Absent
Android	a2	About Herpes Simplex Infection	Partial	Absent	Absent	Partial	Partial	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Partial	Absent	Absent	Absent	Absent	Absent	Absent	Absent
Android	a3	After Sex	Partial	Partial	Partial	Partial	Partial	Partial	Absent	Absent	Partial	Partial	Partial	Partial	Partial	Partial	Partial	Partial	Partial	Partial	Partial	Absent	Partial	Absent
Android	a4	Bacterial Vaginosis Disease	Partial	Partial	Partial	Partial	Partial	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Complete	Absent	Partial	Absent
Android	a5	Bacterial Vaginosis Guide	Partial	Partial	Partial	Partial	Partial	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Complete	Absent	Partial	Absent
Android	a6	Bacterial Vaginosis Treatments	Absent	Absent	Absent	Partial	Partial	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Partial	Absent	Partial	Absent
Android	a7	Chlamydia Disease and Symptoms	Partial	Partial	Partial	Partial	Partial	Complete	Absent	Absent	Absent	Partial	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Partial	Partial
Android	a8	Chlamydia Know it Prevent it Treat it	Absent	Partial	Absent	Partial	Absent	Absent	Absent	Absent	Absent	Partial	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Partial	Absent
Android	a9	Deadly Herpes Virus Acyclovir	Absent	Partial	Partial	Partial	Partial	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Partial	Absent	Absent	Absent	Absent	Absent	Absent	Absent
Android	a10	Female Herpes	Partial	Partial	Partial	Partial	Partial	Partial	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Complete	Absent	Absent	Absent	Absent	Absent	Absent	Absent
Android	a11	Genital herpes guide	Partial	Absent	Absent	Partial	Partial	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Partial	Absent	Absent	Absent	Absent	Absent	Absent	Absent
Android	a12	Genital Herpes Information	Partial	Partial	Partial	Partial	Partial	Partial	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Partial	Absent	Absent	Absent	Absent	Absent	Absent	Absent
Android	a13	Genital Herpes Treatment	Partial	Partial	Partial	Partial	Partial	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Partial	Absent	Absent	Absent	Absent	Absent	Absent	Absent
Android	a14	Genital Herpes Treatment	Partial	Partial	Partial	Partial	Partial	Absent	Absent	Absent	Absent	Partial	Partial	Partial	Partial	Partial	Partial	Partial	Partial	Partial	Partial	Partial	Partial	Partial
Android	a15	Genital Warts Guide	Complete	Partial	Partial	Partial	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Partial	Partial	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent
Android	a16	Genital Warts Guide	Partial	Absent	Partial	Partial	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Partial	Partial	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent
Android	a17	Genital warts info	Partial	Absent	Absent	Partial	Partial	Partial	Absent	Absent	Absent	Absent	Absent	Absent	Partial	Partial	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent

Table 28 continued

Platform	App ID	Title of App	Safe sex	Testing	Diagnosis	Information about STIs/infection	Management	Partner notification	ePrescribing	Contraception	Service provision	Chlamydia	Gonorrhoea	Syphilis	Genital warts	HPV	Genital herpes	Pubic lice	Trichomonas vaginalis	Vaginal candidiasis	Bacterial vaginosis	NGU	Pelvic inflammatory disease	Epididymitis
Android	a18	Genital Warts Info	Complete	Partial	Partial	Complete	Partial	Partial	Absent	Absent	Absent	Absent	Absent	Absent	Partial	Partial	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent
Android	a19	Genital Warts Info	Absent	Partial	Partial	Partial	Partial	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Partial	Partial	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent
Android	a20	Genital Warts Information	Partial	Partial	Partial	Partial	Complete	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Partial	Partial	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent
Android	a21	Get Rid of Bacterial Vaginosis	Absent	Absent	Absent	Partial	Complete	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Partial	Absent	Absent	Absent
Android	a22	Get Rid of Yeast Infection Now!	Absent	Absent	Absent	Complete	Complete	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Complete	Absent	Absent	Absent	Absent
Android	a23	Gonorrhea Disease & Symptoms	Partial	Partial	Partial	Partial	Partial	Complete	Absent	Partial	Partial	Absent	Complete	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Partial	Partial
Android	a24	Guide to STDs	Partial	Partial	Partial	Partial	Partial	Absent	Absent	Absent	Absent	Partial	Partial	Partial	Partial	Partial	Partial	Partial	Partial	Absent	Partial	Absent	Partial	Absent
Android	a25	Herpes Knowledge	Absent	Absent	Absent	Complete	Partial	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Partial	Absent	Absent	Absent	Absent	Absent	Absent	Absent
Android	a26	Herpes Lupus Psoriasis Eczema	Complete	Complete	Complete	Complete	Partial	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Partial	Absent	Absent	Absent	Absent	Absent	Absent	Absent
Android	a27	Herpes Treatment	Partial	Partial	Partial	Complete	Complete	Partial	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Partial	Absent	Absent	Absent	Absent	Absent	Absent	Absent
Android	a28	HPV Infection Information	Partial	Partial	Partial	Partial	Partial	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Partial	Partial	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent
Android	a29	iGirl	Partial	Complete	Complete	Partial	Partial	Complete	Absent	Partial	Complete	Partial	Partial	Partial	Partial	Partial	Partial	Partial	Partial	Partial	Absent	Partial	Absent	Partial
Android	a30	Knowledge of Herpes	Absent	Absent	Absent	Partial	Partial	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Partial	Absent	Absent	Absent	Absent	Absent	Absent	Absent
Android	a31	No Worries	Partial	Complete	Complete	Complete	Complete	Partial	Absent	Partial	Partial	Partial	Partial	Partial	Absent	Absent	Partial	Partial	Absent	Absent	Absent	Partial	Absent	Absent
Android	a32	NORISKS	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Complete	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent
Android	a33	Painful urination in men	Partial	Absent	Partial	Partial	Partial	Absent	Absent	Absent	Absent	Absent	Partial	Partial	Absent	Absent	Partial	Partial	Absent	Absent	Absent	Partial	Absent	Absent
Android	a34	Pelvic inflammatory disease	Partial	Partial	Partial	Partial	Partial	Partial	Absent	Partial	Absent	Partial	Partial	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Complete	Absent

Table 28 continued

Platform	App ID	Title of App	Safe sex	Testing	Diagnosis	Information about STIs/infection	Management	Partner notification	ePrescribing	Contraception	Service provision	Chlamydia	Gonorrhoea	Syphilis	Genital warts	HPV	Genital herpes	Pubic lice	Trichomonas vaginalis	Vaginal candidiasis	Bacterial vaginosis	NGU	Pelvic inflammatory disease	Epididymitis
Android	a35	Protection Sex	Complete	Partial	Partial	Partial	Partial	Partial	Absent	Absent	Partial	Partial	Partial	Partial	Partial	Absent	Partial	Absent	Absent	Absent	Absent	Partial	Absent	Absent
Android	a36	Pubic Lice Crabs Information	Partial	Partial	Partial	Partial	Partial	Complete	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Complete	Absent	Absent	Absent	Absent	Absent	Absent
Android	a37	SAFE	Partial	Complete	Partial	Complete	Complete	Absent	Absent	Complete	Absent	Partial	Partial	Partial	Absent	Partial	Partial	Absent	Absent	Absent	Absent	Absent	Absent	Absent
Android	a38	Safer sex	Partial	Absent	Absent	Partial	Absent	Absent	Absent	Absent	Partial	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent
Android	a39	Sameday doctor - STD Testing	Absent	Complete	Complete	Absent	Absent	Absent	Absent	Absent	Partial	Partial	Partial	Partial	Partial	Partial	Partial	Absent	Partial	Absent	Partial	Partial	Absent	Absent
Android	a40	Sexual Education	Partial	Absent	Absent	Partial	Absent	Absent	Absent	Partial	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Partial	Partial	Partial	Absent	Partial	Absent
Android	a41	Sexually transmitted Stds	Complete	Partial	Partial	Partial	Partial	Complete	Absent	Absent	Absent	Partial	Partial	Partial	Absent	Partial	Partial	Absent	Partial	Absent	Absent	Absent	Absent	Absent
Android	a42	Sheffield SH	Partial	Absent	Absent	Partial	Absent	Absent	Absent	Partial	Complete	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent
Android	a43	STD glossary	Partial	Absent	Partial	Partial	Partial	Partial	Absent	Absent	Absent	Partial	Partial	Partial	Partial	Partial	Partial	Partial	Partial	Partial	Absent	Partial	Partial	Absent
Android	a44	Stop Vaginal Odor	Partial	Partial	Partial	Partial	Partial	Absent	Absent	Absent	Absent	Partial	Partial	Absent	Absent	Absent	Partial	Absent	Absent	Partial	Partial	Absent	Partial	Absent
Android	a45	Syphilis Disease and Symptoms	Partial	Partial	Partial	Partial	Partial	Partial	Absent	Absent	Absent	Absent	Absent	Partial	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent
Android	a46	The Big Book - Symptoms of STD	Partial	Absent	Absent	Partial	Partial	Partial	Absent	Absent	Absent	Partial	Partial	Partial	Partial	Partial	Partial	Partial	Partial	Absent	Partial	Absent	Partial	Absent
Android	a47	The Sex Guide	Partial	Absent	Absent	Partial	Absent	Absent	Absent	Partial	Partial	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent
Android	a48	Treat Genital Herpes Naturally	Partial	Partial	Partial	Partial	Partial	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Complete	Absent	Absent	Absent	Absent	Absent	Absent	Absent
Android	a49	Trichomoniasis information	Partial	Partial	Partial	Partial	Partial	Partial	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Complete	Absent	Absent	Absent	Absent	Absent
Android	a50	UCT Safe Sex	Partial	Absent	Absent	Absent	Absent	Absent	Absent	Partial	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent
Android	a51	Yeast Infection	Absent	Absent	Absent	Partial	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Partial	Absent	Absent	Absent	Absent
Android	a52	Yeast Infection Home Remedy	Absent	Partial	Partial	Partial	Partial	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Complete	Absent	Absent	Absent	Absent

Table 29: Comprehensiveness of content type and STI/infection type for each app (apps available in both platforms)

Platform	App ID	Title of App	Safe sex	Testing	Diagnosis	Information about STIs/infection	Management	Partner notification	ePrescribing	Contraception	Service provision	Chlamydia	Gonorrhoea	Syphilis	Genital warts	HPV	Genital herpes	Pubic lice	Trichomonas vaginalis	Vaginal candidiasis	Bacterial vaginosis	Non-specific urethritis	Pelvic inflammatory disease	Epididymitis
Both	b1	C&SH Somerset	Complete	Partial	Partial	Partial	Partial	Partial	Absent	Partial	Complete	Partial	Partial	Partial	Partial	Absent	Partial	Partial	Partial	Absent	Absent	Absent	Absent	Absent
Both	b2	Conifer Sex Health	Partial	Complete	Partial	Complete	Complete	Partial	Absent	Complete	Complete	Absent	Absent	Absent	Absent	Partial	Absent	Absent	Absent	Partial	Absent	Absent	Absent	Absent
Both	b3	FPA - Find a Clinic	Complete	Complete	Complete	Complete	Complete	Partial	Absent	Complete	Complete	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Partial	Partial
Both	b4	FREE 2 B ME	Partial	Partial	Partial	Partial	Absent	Absent	Absent	Absent	Complete	Partial	Partial	Absent	Absent	Partial	Partial	Absent	Absent	Absent	Absent	Absent	Absent	Absent
Both	b5	Get Them Tested	Partial	Complete	Partial	Complete	Partial	Partial	Absent	Absent	Complete	Partial	Partial	Absent	Partial	Partial	Partial	Absent	Absent	Absent	Partial	Partial	Absent	Absent
Both	b6	Kent C Card	Partial	Absent	Absent	Partial	Absent	Absent	Absent	Partial	Complete	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent
Both	b7	KIS-SK	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Complete	Complete	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent
Both	b8	KYSH - Know Your Sexual Health	Absent	Complete	Partial	Partial	Partial	Absent	Absent	Absent	Complete	Partial	Absent	Partial	Partial	Absent	Partial	Partial	Partial	Absent	Absent	Absent	Absent	Absent
Both	b9	My Sex Doctor	Complete	Complete	Partial	Complete	Partial	Complete	Absent	Complete	Absent	Partial	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Partial	Absent	Absent
Both	b10	NeedTayk now	Complete	Partial	Partial	Partial	Partial	Absent	Absent	Complete	Complete	Partial	Partial	Partial	Partial	Partial	Partial	Absent	Absent	Absent	Absent	Absent	Absent	Absent
Both	b11	SexPositive	Complete	Partial	Absent	Partial	Absent	Absent	Absent	Partial	Absent	Partial	Partial	Partial	Partial	Partial	Partial	Absent	Absent	Absent	Absent	Absent	Absent	Absent
Both	b12	Sexual Health Guide	Complete	Complete	Partial	Complete	Partial	Complete	Absent	Complete	Complete	Partial	Partial	Partial	Partial	Partial	Partial	Partial	Partial	Partial	Absent	Absent	Absent	Absent
Both	b13	Sexual Health Liverpool	Complete	Partial	Absent	Partial	Absent	Absent	Absent	Partial	Complete	Partial	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent
Both	b14	Your rapid diagnosis STD	Partial	Complete	Complete	Complete	Complete	Complete	Absent	Absent	Complete	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent
Both	b15	Your Choice Your Voice (YCV)	Partial	Partial	Absent	Partial	Partial	Absent	Absent	Partial	Complete	Partial	Partial	Partial	Partial	Partial	Partial	Partial	Partial	Partial	Partial	Partial	Partial	Absent

The following tables summarise this information:

Table 30: comprehensiveness of different parameters

	Platform	Any coverage	Completely comprehensive	Partially comprehensive	Absent
Safe sex (%)	iOS n=20	16 (80)	1 (5)	15 (75)	4 (20)
	Android n=52	40 (77)	5 (10)	25 (48)	12 (23)
	Both n=15	13 (87)	7 (47)	6 (40)	2 (13)
	Total n=87	69 (79)	13 (15)	56 (64)	18 (21)
Testing (%)	iOS n=20	11 (55)	2 (10)	9 (45)	9 (45)
	Android n=52	32 (62)	5 (10)	27 (52)	20 (38)
	Both n=15	13 (87)	7 (47)	6 (40)	2 (13)
	Total n=87	56 (64)	14 (16)	42 (48)	31 (36)
Diagnosis (%)	iOS n=20	8 (40)	1 (5)	7 (35)	12 (60)
	Android n=52	34 (66)	4 (8)	30 (58)	18 (35)
	Both n=15	10 (66)	2 (13)	8 (53)	5 (33)
	Total n=87	52 (60)	7 (8)	45 (52)	35 (40)
Information about STIs/infection (%)	iOS n=20	15 (75)	3 (15)	12 (60)	5 (25)
	Android n=52	49 (94)	7 (13)	42 (81)	3 (6)
	Both n=15	14 (93)	6 (40)	8 (53)	1 (7)
	Total n=87	78 (89)	16 (18)	62 (71)	9 (10)
Management (%)	iOS n=20	10 (50)	1 (5)	9 (45)	10 (50)
	Android n=52	41 (79)	6 (12)	35 (67)	11 (21)
	Both n=15	10 (67)	3 (20)	7 (47)	5 (33)
	Total n=87	61 (70)	10 (11)	51 (59)	26 (30)
Partner notification (%)	iOS n=20	4 (20)	1 (5)	3 (15)	16 (80)
	Android n=52	18 (35)	5 (10)	13 (25)	34 (65)
	Both n=15	7 (47)	3 (20)	4 (27)	8 (53)
	Total n=87	29 (33)	9 (10)	20 (23)	58 (67)
ePrescribing (%)	iOS n=20	0	0	0	20 (100)
	Android n=52	0	0	0	52 (100)
	Both n=15	0	0	0	15 (100)
	Total n=87	0	0	0	87 (100)
Contraception (%)	iOS n=20	11 (55)	1 (5)	10 (50)	9 (45)
	Android n=52	9 (17)	1 (2)	8 (15)	43 (83)
	Both n=15	11 (73)	6 (40)	5 (33)	4 (27)
	Total n=87	30 (34)	8 (9)	22 (25)	57 (66)
Service provision (%)	iOS n=20	9 (45)	5 (25)	4 (20)	11 (55)
	Android n=52	9 (18)	3 (6)	6 (12)	43 (83)
	Both n=15	13 (87)	13 (87)	0	2 (13)
	Total n=87	31 (35)	21 (24)	10 (11)	56 (64)

Table 30 continued

STI/infection	Platform	Any coverage	Completely comprehensive	Partially comprehensive	Absent	STI/infection	Platform	Any coverage	Completely comprehensive	Partially comprehensive	Absent
Chlamydia (%)	iOS (n=20)	11 (55)	1 (5)	10 (50)	9 (45)	Trichomonas vaginalis (%)	iOS (n=20)	7 (35)	1 (5)	6 (30)	13 (65)
	Android (n=52)	14 (27)	0	14 (27)	38 (73)		Android (n=52)	10 (19)	1 (2)	9 (17)	42 (81)
	Both (n=15)	12 (80)	2 (13)	10 (67)	3 (20)		Both (n=15)	7 (47)	4 (27)	3 (20)	8 (53)
	Total (n=87)	37 (42)	3 (3)	34 (39)	50 (57)		Total (n=87)	24 (28)	6 (7)	18 (21)	63 (72)
Gonorrhoea (%)	iOS (n=20)	11 (55)	1 (5)	10 (50)	9 (45)	Vaginal candidiasis	iOS (n=20)	9 (45)	2 (10)	7 (35)	11 (55)
	Android (n=52)	14 (27)	1 (2)	13 (25)	38 (73)		Android (n=52)	8 (16)	2 (4)	6 (12)	44 (85)
	Both (n=15)	12 (80)	5 (33)	7 (47)	3 (27)		Both (n=15)	6 (40)	3 (20)	3 (20)	9 (60)
	Total (n=87)	37 (42)	7 (8)	30 (34)	50 (57)		Total (n=87)	23 (26)	7 (8)	16 (18)	64 (74)
Syphilis (%)	iOS (n=20)	11 (55)	1 (5)	10 (50)	9 (45)	Bacterial vaginosis	iOS (n=20)	2 (10)	0	2 (10)	18 (90)
	Android (n=52)	12 (23)	0	12 (23)	40 (77)		Android (n=52)	12 (23)	2 (4)	10 (19)	40 (77)
	Both (n=15)	11 (73)	5 (33)	6 (40)	4 (27)		Both (n=15)	5 (35)	3 (20)	2 (15)	10 (65)
	Total (n=87)	34 (39)	6 (7)	28 (32)	53 (61)		Total (n=87)	19 (22)	5 (6)	14 (16)	68 (78)
Genital warts (%)	iOS (n=20)	10 (50)	2 (10)	8 (40)	10 (50)	NSU	iOS (n=20)	3 (15)	0	3 (15)	17 (85)
	Android (n=52)	14 (27)	0	14 (27)	38 (73)		Android (n=52)	5 (10)	0	5 (10)	47 (90)
	Both (n=15)	11 (73)	4 (27)	7 (47)	4 (27)		Both (n=15)	5 (33)	2 (13)	3 (20)	10 (67)
	Total (n=87)	35 (40)	6 (7)	29 (33)	52 (60)		Total (n=87)	13 (15)	2 (2)	11 (13)	74 (85)
HPV (%)	iOS (n=20)	11 (55)	2 (10)	9 (45)	9 (45)	PID	iOS (n=20)	4 (20)	0	4 (20)	16 (80)
	Android (n=52)	15 (29)	0	15 (29)	37 (71)		Android (n=52)	15 (29)	1 (2)	14 (27)	37 (71)
	Both (n=15)	11 (74)	4 (27)	7 (47)	4 (27)		Both (n=15)	4 (27)	2 (13)	2 (13)	11 (73)
	Total (n=87)	37 (43)	6 (7)	31 (36)	50 (57)		Total (n=87)	23 (26)	3 (3)	20 (23)	64 (74)
Genital herpes (%)	iOS (n=20)	11 (55)	1 (5)	10 (50)	9 (45)	Epididymitis	iOS (n=20)	3 (15)	0	3 (15)	17 (85)
	Android (n=52)	24 (46)	2 (4)	22 (42)	28 (54)		Android (n=52)	2 (4)	0	2 (4)	50 (96)
	Both (n=15)	12 (80)	4 (27)	8 (53)	3 (20)		Both (n=15)	1 (7)	0	1 (7)	14 (93)
	Total (n=87)	47 (54)	7 (8)	40 (46)	40 (46)		Total (n=87)	6 (7)	0	6 (7)	81 (93)
Pubic lice (%)	iOS (n=20)	7 (35)	0	7 (35)	13 (65)						
	Android (n=52)	8 (15)	1 (2)	7 (13)	44 (85)						
	Both (n=15)	8 (53)	4 (27)	4 (27)	7 (47)						
	Total (n=87)	23 (26)	5 (6)	18 (21)	64 (74)						

Table 31: summary table of comprehensiveness of apps (iOS)

Platform	App ID	Title of App	Number of content parameters fully comprehensive	Number of STI/infections fully comprehensive	Number of content parameters partially comprehensive	Number of STI/infections partially comprehensive	No of content parameters covered total	Number of STI/infections covered total
iOS	i1	Sexually transmitted disease (STD) triage	2	0	4	7	6	7
iOS	i2	STD Guide	0	7	7	0	7	7
iOS	i3	STD Glossary	1	0	5	11	6	11
iOS	i4	iCondom Coventry	1	0	0	0	1	0
iOS	i5	99 - The Talk	3	2	3	11	6	13
iOS	i6	Safer Sex	0	0	2	0	2	0
iOS	i7	STD411	1	0	4	4	5	4
iOS	i8	Private Girl Tips	0	0	5	9	5	9
iOS	i9	SWISH APP	1	0	0	0	1	0
iOS	i10	Sex Health Dictionary & Sexual Health Video Lessons	0	0	6	12	6	12
iOS	i11	Safesex Guide	0	0	4	11	4	11
iOS	i12	Safe sex	0	0	2	0	2	0
iOS	i13	SafeSex101	2	0	5	9	7	9
iOS	i14	SAFE - Safety Awareness for Everyone	1	0	5	6	6	6
iOS	i15	iSex - Sex Education and Terminology	0	0	3	10	3	10
iOS	i16	Girls's guide for sex myths	1	0	2	0	3	0
iOS	i17	CaSH 2 U	1	0	1	0	2	0
iOS	i18	Pap Test Lite	0	0	4	1	4	1
iOS	i19	Natural Yeast Infection Solutions	0	1	3	0	3	1
iOS	i20	A woman's guide to yeast infections	1	1	3	0	4	1

Table 32: summary table of comprehensiveness of apps (Android)

Platform	App ID	Title of App	Number of content parameters fully comprehensive	Number of STI/infections fully comprehensive	Number of content parameters partially comprehensive	Number of STI/infections partially comprehensive	No of content parameters covered total	Number of STI/infections covered total
Android	a1	Abnormal Vaginal Discharge	0	0	3	4	3	4
Android	a2	About Herpes Simplex Infection	0	0	3	1	3	1
Android	a3	After Sex	0	0	7	11	7	11
Android	a4	Bacterial Vaginosis Disease	0	1	5	1	5	2
Android	a5	Bacterial Vaginosis Guide	0	1	5	1	5	2
Android	a6	Bacterial Vaginosis Treatments	0	0	2	2	2	2
Android	a7	Chlamydia Disease and Symptoms	1	0	5	3	6	3
Android	a8	Chlamydia Know it Prevent it Treat it	0	0	2	2	2	2
Android	a9	Deadly Herpes Virus Acyclovir	0	0	4	1	4	1
Android	a10	Female Herpes	0	1	6	0	6	1
Android	a11	Genital herpes guide	0	0	3	1	3	1
Android	a12	Genital Herpes Information	0	0	6	1	6	1
Android	a13	Genital Herpes Treatment	0	0	5	1	5	1
Android	a14	Genital Herpes Treatment	0	0	5	1	5	1
Android	a15	Genital Warts Guide	1	0	3	2	4	2
Android	a16	Genital Warts Guide	0	0	3	2	3	2
Android	a17	Genital warts info	0	0	4	2	4	2
Android	a18	Genital Warts Info	2	0	4	2	6	2
Android	a19	Genital Warts Info	0	0	4	2	4	2
Android	a20	Genital Warts Information	1	0	4	2	5	2
Android	a21	Get Rid of Bacterial Vaginosis	1	0	1	1	2	1
Android	a22	Get Rid of Yeast Infection Now !	2	1	0	0	2	1
Android	a23	Gonorrhea Disease & Symptoms	1	1	5	2	6	3
Android	a24	Guide to STDs	0	0	5	10	5	10
Android	a25	Herpes Knowledge	1	0	1	1	2	1
Android	a26	Herpes Lupus Psoriasis Eczema	4	0	1	1	5	1

Table 32 continued

Platform	App ID	Title of App	Number of content parameters fully comprehensive	Number of STI/infections fully comprehensive	Number of content parameters partially comprehensive	Number of STI/infections partially comprehensive	No of content parameters covered total	Number of STI/infections covered total
Android	a27	Herpes Treatment	2	0	4	1	6	1
Android	a28	HPV Infection Information	0	0	5	2	5	2
Android	a29	iGirl	4	0	4	10	8	10
Android	a30	Knowledge of Herpes	0	0	2	1	2	1
Android	a31	No Worries	4	0	4	6	8	6
Android	a32	NORISKS	1	0	0	0	1	0
Android	a33	Painful urination in men	0	0	4	5	4	5
Android	a34	Pelvic inflammatory disease	0	1	7	2	7	3
Android	a35	Protection - Sex	1	0	6	6	7	6
Android	a36	Pubic Lice Crabs Information	1	1	5	0	6	1
Android	a37	SAFE	4	0	2	5	6	5
Android	a38	Safer sex	0	0	3	0	3	0
Android	a39	Samedaydoctor - STD Testing	2	0	1	9	3	9
Android	a40	Sexual Education	0	0	3	4	3	4
Android	a41	Sexually transmitted Stds	2	0	4	6	6	6
Android	a42	Sheffield SH	1	0	3	0	4	0
Android	a43	STD glossary	0	0	5	11	5	11
Android	a44	Stop Vaginal Odor	0	0	5	6	5	6
Android	a45	Syphilis Disease and Symptoms	0	0	6	1	6	1
Android	a46	The Big Book - Symptoms of STD	0	0	4	10	4	10
Android	a47	The Sex Guide	0	0	4	0	4	0
Android	a48	Treat Genital Herpes Naturally	0	1	5	0	5	1
Android	a49	Trichomoniasis information	0	1	6	0	6	1
Android	a50	UCT Safe Sex	0	0	2	0	2	0
Android	a51	Yeast Infection	0	0	1	1	1	1
Android	a52	Yeast Infection Home Remedy	0	1	4	0	4	1

Table 33: summary table of comprehensiveness of apps (Both)

Platform	App ID	Title of App	Number of content parameters fully comprehensive	Number of STI/infections fully comprehensive	Number of content parameters partially comprehensive	Number of STI/infections partially comprehensive	No of content parameters covered total	Number of STI/infections covered total
Both	b1	C&SH Somerset	2	1	6	7	8	8
Both	b2	Conifer Sex Health	5	7	3	2	8	9
Both	b3	FPA - Find a Clinic	7	11	1	2	8	13
Both	b4	FREE 2 B ME	1	0	4	4	5	4
Both	b5	Get Them Tested	3	1	4	7	7	8
Both	b6	Kent C Card	1	0	3	0	4	0
Both	b7	KIS-SK	2	0	0	0	2	0
Both	b8	KYSH - Know Your Sexual Health	2	1	3	5	5	6
Both	b9	My Sex Doctor	5	10	2	2	7	12
Both	b10	NeedTayKnow	3	0	4	6	7	6
Both	b11	SexPositive	1	0	3	6	4	6
Both	b12	Sexual Health Guide	6	0	2	9	8	9
Both	b13	Sexual Health Liverpool	2	0	3	1	5	1
Both	b14	Your rapid diagnosis STD	6	11	1	0	7	11
Both	b15	Your Choice Your Voice (YCYV)	1	0	5	12	6	12

Table 34: number of content parameters (e.g. diagnosis) covered fully comprehensively by platform

Platform	No of content parameters fully comprehensive (n=9)								
	0	1	2	3	4	5	6	7	Median (IQR)
iOS (n=20)	9	8	2	1	0	0	0	0	1 (1)
Android (n=52)	33	10	5	0	4	0	0	0	0 (1)
Both (n=15)	0	4	4	2	0	2	2	1	2 (4)
Total (n=87)	42	22	11	3	4	2	2	1	1 (2)

Table 35: number of content parameters (e.g. diagnosis) covered partially comprehensively (by platform)

Platform	No of content parameters partially comprehensive (n=9)								
	0	1	2	3	4	5	6	7	Median (IQR)
iOS (n=20)	2	1	3	4	3	5	1	1	3 (3)
Android (n=52)	2	5	5	8	13	12	5	2	4 (2)
Both (n=15)	1	2	2	5	3	1	1	0	3 (2)
Total (n=87)	5	8	10	17	19	18	7	3	4 (3)

Table 36: number of content parameters (e.g. diagnosis) covered total (by platform)

Platform	No of content parameters covered total (n=9)									
	0	1	2	3	4	5	6	7	8	Median (IQR)
iOS (n=20)	0	2	3	3	3	2	4	3	0	4 (4)
Android (n=52)	0	2	7	7	9	11	11	3	2	5 (3)
Both (n=15)	0	0	1	0	2	3	1	4	4	6.5 (4)
Total (n=87)	0	4	11	10	14	16	16	10	6	5 (3)

Table 37: number of STI/infections covered fully

Platform	No of STI/infections covered fully comprehensively (n=13)												
	0	1	2	3	4	5	6	7	8	9	10	11	Median
iOS (n=20)	16	2	1	0	0	0	0	1	0	0	0	0	0 (0)
Android (n=52)	42	10	0	0	0	0	0	0	0	0	0	0	0 (0)
Both (n=15)	8	3	0	0	0	0	0	1	0	0	1	2	0 (1)
Total (n=87)	66	15	1	0	0	0	0	2	0	0	1	2	0

Table 38: number of STI/infections covered partially

Platform	No of STI/infections covered partially comprehensively (n=13)													
	0	1	2	3	4	5	6	7	8	9	10	11	12	Median
iOS (n=20)	9	1	0	0	1	0	1	1	1	1	2	2	1	1 (9)
Android (n=52)	11	13	11	1	2	2	4	0	0	1	3	2	0	2 (5)
Both (n=15)	3	1	3	0	1	1	2	2	0	1	0	0	1	3 (5)
Total (n=87)	23	17	14	1	4	3	7	3	1	3	5	4	2	2 (6)

Table 39: number of STI/infections covered total

Platform	No of STI/infections covered total (n=13)														
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	Median
iOS (n=20)	6	3	0	0	1	0	1	2	1	1	2	1	1	1	4 (9)
Android (n=52)	5	19	11	3	2	2	4	0	0	1	3	2	0	0	2 (3)
Both (n=15)	2	1	0	0	1	0	3	0	2	2	0	1	2	1	7 (8)
Total (n=87)	13	23	11	3	4	2	8	2	3	4	5	4	3	2	2 (6)

5.4 ACCURACY OF APPS

As with the comprehensiveness and coverage of apps, there was wide variability in accuracy in terms of parameter measured, app and platform. Only 15% (13/87) of apps were found to be completely accurate and 32% (28/87) of apps were assessed as being partially accurate. Just over half of the apps assessed (53%) provided information that was found to be 'majority accurate', i.e. errors were found in one aspect of the information or no more than two minor errors were present throughout (see Table 40).

When looking at individual parameters (see Table 41), a far greater proportion of apps available in both platforms, compared to iOS apps and Android apps, were found to be completely accurate, with the exception of bacterial vaginosis, where a greater proportion of iOS apps were accurate. However, there were only a small number of apps covering bacterial vaginosis.

Content parameters (safe sex, testing, diagnosis, information about sti/genital infection, management, partner notification, eprescribing, contraception, and service provision)

Most apps were found to be majority accurate when assessing the individual content parameters. The accuracy of apps was notably low for information about STIs/infection (only 19% (15/78) completely accurate), management (only 16% (10/61) completely accurate) and partner notification (only 20 % (6/30) completely accurate). The only parameter measured to be completely inaccurate was management, where one app was assessed as such. The content parameter which was portrayed most accurately was service provision, with 72% (21/29) apps providing completely accurate information on this parameter.

Overall, the median content type accuracy percentage was 77% (IQR 27.7) (see Table 42). This varied from 95.9% (IQR 8.3) for apps available in both platforms, to 69.5% (IQR 29.6) for

Android apps, with iOS apps having a median content type accuracy percentage of 76.5% (IQR 30).

STI/Genital infections

As with the other parameters, there was wide variability in terms of the accuracy dependent on app and platform. Of the five STIs that Public Health England identify as being of particular interest:

Chlamydia: The information provided on chlamydia was assessed as being completely accurate in only 27% (10/87) of apps. As with other parameters, this did vary according to platform, with 67% (8/12) apps available in both platforms providing completely accurate information, as opposed to no Android apps. The majority of apps covering chlamydia were found to be 'majority accurate' (n=23 (62%)). Only one app was found to contain fully comprehensive, completely accurate information on chlamydia.

Gonorrhoea: Accuracy of information on gonorrhoea was found to similar to that on chlamydia, with 27% (10/37) of apps providing completely accurate information, 65% (24/37) providing majority accurate information and 8% (3/37) providing partially accurate information. Again, there were no Android apps that provided completely accurate information, whereas 58% (7/12) of apps available in both platforms did.

Syphilis: The information on syphilis was of a slightly higher quality, with 35% (12/34) apps providing completely accurate information on this infection. The discrepancy of quality of information between different platforms continued with 73% (8/11) of apps available in both platforms providing completely accurate information, whilst 27% (3/11) of iOS apps did and only 8% (1/12) of Android apps did.

Genital warts: The accuracy of information on genital warts was slightly lower than the information on chlamydia and gonorrhoea: Twenty two percent (8/36) of apps provided completely accurate information; 58% (21/36) of apps provided information that was majority

accurate; 19% (7/36) provided information that was partially accurate. Again, apps available in both platforms were the most accurate with 64% (7/11) providing completely accurate information, as opposed to no Android apps.

Genital herpes: Only 21% (10/47) provided completely accurate information, whereas 30% (14/47) were partially accurate. Again, no Android apps provided completely accurate information.

Android apps provided particularly poor quality information in several parameters with 60% (9/15) of apps providing information on HPV, 50% (12/24) of apps providing information on genital herpes, 63% (5/7) of apps providing information on vaginal candidiasis and 45% (5/11) of apps providing information on bacterial vaginosis being graded as only partially accurate.

The overall median STI/infection type accuracy percentage was 81% (IQR 36) (see Table 43). As with content type accuracy, this varied from 90.8 (IQR 12) for apps available in both platforms, to 73.5% (IQR 33.3) for Android apps.

Overall accuracy

Both reviewers of each app made an assessment of the overall accuracy of the app (see Table 41). 15% (13/87) were rated as being completely accurate, 53% (46/87) as being partially accurate and 32% (28/87) as being partially accurate. No android apps were rated as completely accurate, whereas 30% (6/20) of iOS apps were and 47% (7/15) of apps available in both platforms were.

The total overall median accuracy percentage was 75.2% (IQR 30.5) (see Table 43). Reflecting content type accuracy and STI/infection type accuracy, apps available in both platforms had the highest overall accuracy percentage (94.6% (IQR 6)), whilst Android apps had the lowest overall accuracy percentage (66.7 (IQR 29.7)).

Table 40: Accuracy of content type and STI/infection type for each app

Platform	App ID	Title of App	Safe Sex	Testing	Diagnosis	Information about STIs/infection	Management	Partner notification	ePrescribing	Contraception	Service provision	Chlamydia	Gonorrhea	Syphilis	Genital warts	HPV	Genital herpes	Pubic lice	Trichomonas vaginalis	Vaginal candidiasis	Bacterial vaginosis	Non-specific urethritis	Pelvic inflammatory disease	Epididymitis	Overall content accuracy
iOS	i1	Sexually transmitted disease (STD) triage	Completely	Completely	-	Completely	Completely	Completely	-	-	Majority	Completely	Completely	Completely	Majority	Completely	Completely	-	-	Completely	-	-	-	-	Completely
iOS	i2	STD Guide	Partially	Partially	Partially	Partially	Majority	Majority	-	-	Partially	Partially	Partially	Partially	Majority	Majority	Majority	-	Partially	-	-	-	-	-	Partially
iOS	i3	STD Glossary	Partially	Partially	Partially	Majority	-	Majority	-	Partially	-	Majority	Majority	Majority	Majority	Partially	Majority	Majority	Majority	Majority	-	Majority	Majority	-	Majority
iOS	i4	iCondom Coventry	-	-	-	-	-	-	-	-	Completely	-	-	-	-	-	-	-	-	-	-	-	-	-	Completely
iOS	i5	99 - The Talk	Completely	Completely	Majority	Completely	Completely	-	-	Completely	-	Majority	Completely	Completely	Completely	Completely	Completely	Completely	Completely	Completely	Completely	Completely	Completely	Completely	Completely
iOS	i6	Safer Sex	Majority	-	-	-	-	-	-	Majority	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Majority
iOS	i7	STD411	Completely	Completely	-	Completely	-	-	-	Completely	Completely	Completely	Completely	Completely	-	-	Completely	-	-	-	-	-	-	-	Completely
iOS	i8	Private Girl Tips	Majority	Majority	-	Majority	Majority	Majority	-	-	-	Majority	Majority	Majority	Majority	Majority	Majority	Majority	Majority	Majority	-	-	-	-	Majority
iOS	i9	SWISH APP	-	-	-	-	-	-	-	-	Completely	-	-	-	-	-	-	-	-	-	-	-	-	-	Completely
iOS	i10	Sex Health Dictionary & Sexual Health Video Lessons	Completely	Majority	Majority	Majority	Majority	-	-	Majority	-	Majority	Majority	Majority	Majority	-	Partially	Majority	Majority	Majority	Majority	-	Majority	Majority	Majority
iOS	i11	Safesex Guide	Majority	-	-	Majority	Majority	-	-	Majority	-	Majority	Majority	Majority	Majority	Majority	Majority	Majority	Majority	Majority	Partially	-	Majority	-	Majority
iOS	i12	Safe sex	Majority	-	-	-	-	-	-	Majority	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Majority
iOS	i13	SafeSex101	Majority	Completely	Majority	Completely	Majority	-	-	Majority	Completely	Majority	Majority	Partially	Majority	Majority	Majority	Completely	Majority	-	-	-	-	-	Majority
iOS	i14	SAFE - Safety Awareness for Everyone	Completely	Partially	Majority	Majority	Majority	-	-	Majority	Completely	Majority	Majority	Majority	Majority	Majority	Majority	-	-	-	-	-	-	-	Majority
iOS	i15	iSex - Sex Education and Terminology	Majority	-	-	Majority	-	-	-	Partially	-	Majority	Majority	Majority	Majority	Majority	Majority	Completely	-	Majority	-	-	Majority	Completely	Majority
iOS	i16	Girls's guide for sex myths	Majority	-	-	Majority	-	-	-	Majority	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Majority
iOS	i17	CaSH 2 U	-	Completely	-	-	-	-	-	-	Completely	-	-	-	-	-	-	-	-	-	-	-	-	-	Completely
iOS	i18	Pap Test Lite	-	Majority	Majority	Majority	-	-	-	-	Majority	-	-	-	-	Majority	-	-	-	-	-	-	-	-	Majority
iOS	i19	Natural Yeast Infection Solutions	Majority	-	-	Partially	Not accurate	-	-	-	-	-	-	-	-	-	-	-	-	Partially	-	-	-	-	Partially
iOS	i20	A woman's guide to yeast infections	Completely	Majority	Majority	Partially	Partially	-	-	-	-	-	-	-	-	-	-	-	-	Partially	-	-	-	-	Partially

Table 40 continued

Platform	App ID	Title of App	Safe sex	Testing	Diagnosis	Information about STIs/infection	Management	Partner notification	ePrescribing	Contraception	Service provision	Chlamydia	Gonorrhoea	Syphilis	Genital warts	HPV	Genital herpes	Pubic lice	Trichomonas vaginalis	Vaginal candidiasis	Bacterial vaginosis	Non-specific urethritis	Pelvic inflammatory disease	Epididymitis	Overall content accuracy
Android	a1	Abnormal Vaginal Discharge	Completely	-	-	Majority	Majority	-	-	-	-	-	-	-	-	-	-	-	Partially	Majority	Partially	-	Majority	-	Partially
Android	a2	About Herpes Simplex Infection	Majority	-	-	Majority	Partially	-	-	-	-	-	-	-	-	-	Partially	-	-	-	-	-	-	-	Partially
Android	a3	After Sex	Majority	Majority	Majority	Majority	Majority	Majority	-	-	Majority	Majority	Majority	Majority	Majority	Partially	Majority	Majority	Majority	Majority	Majority	-	Majority	-	Majority
Android	a4	Bacterial Vaginosis Disease	Majority	Majority	Majority	Majority	Majority	-	-	-	-	-	-	-	-	-	-	-	-	-	Majority	-	Majority	-	Majority
Android	a5	Bacterial Vaginosis Guide	Majority	Partially	Partially	Partially	Partially	-	-	-	-	-	-	-	-	-	-	-	-	-	Partially	-	Majority	-	Partially
Android	a6	Bacterial Vaginosis Treatments	-	-	-	Majority	Partially	-	-	-	-	-	-	-	-	-	-	-	-	-	Partially	-	Majority	-	Partially
Android	a7	Chlamydia Disease and Symptoms	Majority	Completely	Majority	Completely	Majority	Majority	-	-	-	Majority	-	-	-	-	-	-	-	-	-	-	Majority	Majority	Partially
Android	a8	Chlamydia Know it Prevent it Treat it	Majority	Majority	Majority	Majority	-	-	-	-	-	Majority	-	-	-	-	-	-	-	-	-	-	Majority	-	Majority
Android	a9	Deadly Herpes Virus Acyclovir	-	Majority	Majority	Partially	Partially	-	-	-	-	-	-	-	-	-	Partially	-	-	-	-	-	-	-	Partially
Android	a10	Female Herpes	Majority	Partially	Partially	Majority	Partially	Majority	-	-	-	-	-	-	-	-	Majority	-	-	-	-	-	-	-	Majority
Android	a11	Genital herpes guide	Majority	-	-	Partially	Majority	-	-	-	-	-	-	-	-	-	Partially	-	-	-	-	-	-	-	Partially
Android	a12	Genital Herpes Information	Majority	Majority	Majority	Majority	Majority	Majority	-	-	-	-	-	-	-	-	Majority	-	-	-	-	-	-	-	Majority
Android	a13	Genital Herpes Treatment	Majority	Partially	Partially	Majority	Majority	-	-	-	-	-	-	-	-	-	Partially	-	-	-	-	-	-	-	Partially
Android	a14	Genital Herpes Treatment	Majority	Partially	Partially	Partially	Majority	-	-	-	-	-	-	-	-	-	Partially	-	-	-	-	-	-	-	Partially
Android	a15	Genital Warts Guide	Majority	-	Majority	Partially	-	-	-	-	-	-	-	-	Partially	Partially	-	-	-	-	-	-	-	-	Partially
Android	a16	Genital Warts Guide	Majority	-	Majority	Partially	-	-	-	-	-	-	-	-	Partially	Partially	-	-	-	-	-	-	-	-	Partially
Android	a17	Genital warts info	Partially	-	-	Partially	Partially	Partially	-	-	-	-	-	-	Partially	Partially	-	-	-	-	-	-	-	-	Partially

Table 40 continued

Platform	App ID	Title of App	Safe sex	Testing	Diagnosis	Information about STIs/infection	Management	Partner notification	ePrescribing	Contraception	Service provision	Chlamydia	Gonorrhoea	Syphilis	Genital warts	HPV	Genital herpes	Pubic lice	Trichomonas vaginalis	Vaginal candidiasis	Bacterial vaginosis	Non-specific urethritis	Pelvic inflammatory disease	Epididymitis	Overall content accuracy
Android	a18	Genital Warts Info	Majority	-	-	Partially	Partially	Partially	-	-	-	-	-	-	Partially	Partially	-	-	-	-	-	-	-	-	Partially
Android	a19	Genital Warts Info	-	Partially	Partially	Partially	Partially	-	-	-	-	-	-	-	Partially	Partially	-	-	-	-	-	-	-	-	Partially
Android	a20	Genital Warts Information	Majority	Majority	Majority	Majority	Majority	Majority	-	-	-	-	-	-	Majority	Majority	-	-	-	-	-	-	-	-	Majority
Android	a21	Get Rid of Bacterial Vaginosis	-	-	-	Partially	Partially	-	-	-	-	-	-	-	-	-	-	-	-	-	Partially	-	-	-	Partially
Android	a22	Get Rid of Yeast Infection Now!	-	-	-	Partially	Partially	-	-	-	-	-	-	-	-	-	-	-	-	Partially	-	-	-	-	Partially
Android	a23	Gonorrhea Disease & Symptoms	Majority	Majority	Majority	Majority	Majority	Completely	-	-	-	-	Majority	-	-	-	-	-	-	-	-	-	Completely	Completely	Majority
Android	a24	Guide to STDs	Majority	Majority	Majority	Partially	Partially	-	-	-	-	Partially	Partially	Majority	Partially	Partially	Majority	Majority	Partially	-	Majority	-	Majority	-	Partially
Android	a25	Herpes Knowledge	-	-	-	Partially	Majority	-	-	-	-	-	-	-	-	-	Partially	-	-	-	-	-	-	-	Partially
Android	a26	Herpes Lupus Psoriasis Eczema	Completely	Completely	Completely	Completely	Majority	-	-	-	-	-	-	-	-	-	Majority	-	-	-	-	-	-	-	Majority
Android	a27	Herpes Treatment	Majority	Majority	Partially	Majority	Partially	Majority	-	-	-	-	-	-	-	-	Partially	-	-	-	-	-	-	-	Partially
Android	a28	HPV Infection Information	Majority	Majority	Majority	Majority	Majority	-	-	-	-	-	-	-	Majority	Majority	-	-	-	-	-	-	-	-	Majority
Android	a29	iGirl	Majority	Majority	Majority	Majority	Majority	Majority	-	Majority	-	Majority	Majority	Majority	Majority	Majority	Majority	Majority	Majority	-	Majority	-	Majority	-	Majority
Android	a30	Knowledge of Herpes	-	-	-	Partially	Partially	-	-	-	-	-	-	-	-	-	Partially	-	-	-	-	-	-	-	Partially
Android	a31	No Worries	Majority	Majority	Majority	Majority	Majority	Majority	-	Majority	Completely	Majority	Majority	Majority	-	-	Majority	Majority	-	-	-	Majority	-	-	Majority
Android	a32	NORISKS	-	-	-	-	-	-	-	-	Completely	-	-	-	-	-	-	-	-	-	-	-	-	-	Majority
Android	a33	Painful urination in men	Majority	Majority	Majority	Majority	Majority	-	-	-	-	-	Majority	Partially	-	-	Partially	Majority	-	-	-	Majority	-	-	Majority
Android	a34	Pelvic inflammatory disease	Majority	Majority	Majority	Majority	Majority	Majority	-	Majority	-	Majority	Majority	-	-	-	-	-	-	-	-	-	Majority	-	Majority

Table 40 continued

Platform	App ID	Title of App	Safe sex	Testing	Diagnosis	Information about STIs/infection	Management	Partner notification	ePrescribing	Contraception	Service provision	Chlamydia	Gonorrhoea	Syphilis	Genital warts	HPV	Genital herpes	Pubic lice	Trichomonas vaginalis	Vaginal candidiasis	Bacterial vaginosis	Non-specific urethritis	Pelvic inflammatory disease	Epididymitis	Overall content accuracy
Android	a35	Protection - Sex	Completely	Completely	Completely	Majority	Majority	Completely	-	-	Completely	Majority	Majority	Majority	Majority	-	Majority	-	-	-	-	Partially	-	-	Majority
Android	a36	Pubic Lice Crabs Information	Majority	-	Majority	Majority	Majority	Majority	-	-	-	-	-	-	-	-	-	Majority	-	-	-	-	-	-	Majority
Android	a37	SAFE	Majority	Majority	Partially	Majority	Majority	-	-	Majority	-	Majority	Majority	Majority	Majority	Majority	Partially	-	-	-	-	-	-	-	Majority
Android	a38	Safer sex	Completely	-	-	Majority	-	-	-	-	Majority	-	-	-	-	-	-	-	-	-	-	-	-	-	Majority
Android	a39	Samedaydoct or - STD Testing	-	Majority	Majority	-	-	-	-	-	Majority	Majority	Majority	Majority	Majority	Majority	Majority	-	Majority	-	-	Majority	-	-	Majority
Android	a40	Sexual Education	Majority	-	-	Majority	-	-	-	Partially	-	-	-	-	-	-	-	-	Majority	Partially	Majority	-	Majority	-	Majority
Android	a41	Sexually transmitted Stds	Majority	Majority	Majority	Majority	Majority	Majority	-	-	-	Majority	Majority	Majority	-	Partially	Majority	-	Majority	-	-	-	-	-	Majority
Android	a42	Sheffield SH	Majority	-	-	Completely	-	-	-	Completely	Completely	-	-	-	-	-	-	-	-	-	-	-	-	-	Majority
Android	a43	STD glossary	Majority	-	Majority	Majority	Majority	Majority	-	-	-	Majority	Majority	Majority	Partially	Partially	Majority	Majority	Majority	Completely	-	Majority	Majority	-	Majority
Android	a44	Stop Vaginal Odor	Majority	Partially	Partially	Partially	Partially	-	-	-	-	Partially	Partially	-	-	-	Partially	-	-	Partially	Partially	-	Partially	-	Partially
Android	a45	Syphilis Disease and Symptoms	Majority	Majority	Majority	Majority	Majority	Majority	-	-	-	-	-	Majority	-	-	-	-	-	-	-	-	-	-	Majority
Android	a46	The Big Book - Symptoms of STD	Majority	-	-	Majority	Majority	Majority	-	-	-	Majority	Majority	Completely	Majority	Majority	Majority	Majority	Majority	-	Majority	-	Majority	-	Majority
Android	a47	The Sex Guide	Majority	-	-	Majority	Majority	-	-	Majority	Partially	-	-	-	-	-	-	-	-	-	-	-	-	-	Majority
Android	a48	Treat Genital Herpes Naturally	Majority	Partially	Partially	Majority	Majority	-	-	-	-	-	-	-	-	-	Partially	-	-	-	-	-	-	-	Partially
Android	a49	Trichomonias is information	Majority	Majority	Majority	Majority	Majority	Majority	-	-	-	-	-	-	-	-	-	-	Majority	-	-	-	-	-	Majority
Android	a50	UCT Safe Sex	Majority	-	-	-	-	-	-	Majority	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Majority
Android	a51	Yeast Infection	-	-	-	Partially	-	-	-	-	-	-	-	-	-	-	-	-	-	Partially	-	-	-	-	Partially
Android	a52	Yeast Infection Home Remedy	-	Majority	Majority	Partially	Partially	-	-	-	-	-	-	-	-	-	-	-	-	Partially	-	-	-	-	Partially

Table 40 continued

Platform	App ID	Title of App	Safe sex	Testing	Diagnosis	Information about STIs/infection	Management	Partner notification	ePrescribing	Contraception	Service provision	Chlamydia	Gonorrhoea	Syphilis	Genital warts	HPV	Genital herpes	Pubic lice	Trichomonas vaginalis	Vaginal candidiasis	Bacterial vaginosis	Non-specific urethritis	Pelvic inflammatory disease	Epididymitis
Both	b1	C&SH Somerset	Complete	Partial	Partial	Partial	Partial	Partial	Absent	Partial	Complete	Partial	Partial	Partial	Partial	Absent	Partial	Partial	Partial	Absent	Absent	Absent	Absent	Absent
Both	b2	Conifer Sex Health	Partial	Complete	Partial	Complete	Complete	Partial	Absent	Complete	Complete	Absent	Absent	Absent	Absent	Partial	Absent	Absent	Absent	Partial	Absent	Absent	Absent	Absent
Both	b3	FPA - Find a Clinic	Complete	Complete	Complete	Complete	Complete	Partial	Absent	Complete	Complete	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Partial	Partial
Both	b4	FREE 2 B ME	Partial	Partial	Partial	Partial	Absent	Absent	Absent	Absent	Complete	Partial	Partial	Absent	Absent	Partial	Partial	Absent	Absent	Absent	Absent	Absent	Absent	Absent
Both	b5	Get Them Tested	Partial	Complete	Partial	Complete	Partial	Partial	Absent	Absent	Complete	Partial	Partial	Absent	Partial	Partial	Partial	Absent	Absent	Absent	Partial	Partial	Absent	Absent
Both	b6	Kent C Card	Partial	Absent	Absent	Partial	Absent	Absent	Absent	Partial	Complete	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent
Both	b7	KIS-SK	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Complete	Complete	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent
Both	b8	KYSH - Know Your Sexual Health	Absent	Complete	Partial	Partial	Partial	Absent	Absent	Absent	Complete	Partial	Absent	Partial	Partial	Absent	Partial	Partial	Absent	Absent	Absent	Absent	Absent	Absent
Both	b9	My Sex Doctor	Complete	Complete	Partial	Complete	Partial	Complete	Absent	Complete	Absent	Partial	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Partial	Absent	Absent
Both	b10	NeedTayk now	Complete	Partial	Partial	Partial	Partial	Absent	Absent	Complete	Complete	Partial	Partial	Partial	Partial	Partial	Partial	Absent	Absent	Absent	Absent	Absent	Absent	Absent
Both	b11	SexPositive	Complete	Partial	Absent	Partial	Absent	Absent	Absent	Partial	Absent	Partial	Partial	Partial	Partial	Partial	Partial	Absent	Absent	Absent	Absent	Absent	Absent	Absent
Both	b12	Sexual Health Guide	Complete	Complete	Partial	Complete	Partial	Complete	Absent	Complete	Complete	Partial	Partial	Partial	Partial	Partial	Partial	Partial	Partial	Partial	Absent	Absent	Absent	Absent
Both	b13	Sexual Health Liverpool	Complete	Partial	Absent	Partial	Absent	Absent	Absent	Partial	Complete	Partial	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent
Both	b14	Your rapid diagnosis STD	Partial	Complete	Complete	Complete	Complete	Complete	Absent	Absent	Complete	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent
Both	b15	Your Choice Your Voice (YCV)	Partial	Partial	Absent	Partial	Partial	Absent	Absent	Partial	Complete	Partial	Partial	Partial	Partial	Partial	Partial	Partial	Partial	Partial	Partial	Partial	Partial	Absent

Table 41: Accuracy of different parameters

	Platform	Completely accurate	Majority accurate	Partially Accurate	Not accurate
Safe sex (%)	iOS (n=16)	6 (38)	8 (50)	2 (13)	0
	Android (n=41)	4 (10)	36 (88)	1 (2)	0
	Both (n=13)	13 (100)	0	0	0
	Total (n=70)	23 (31)	44 (63)	3 (4)	0
Testing (%)	iOS (n=12)	5 (42)	4 (33)	3 (25)	0
	Android (n=30)	3 (10)	20 (67)	7 (23)	0
	Both (n=13)	12 (92)	1 (8)	0	0
	Total (n=55)	20 (36)	25 (45)	10 (18)	0
Diagnosis (%)	iOS (n=8)	0	6(75)	2 (25)	0
	Android (n=34)	2 (6)	23 (68)	9 (27)	0
	Both (n=9)	7 (78)	1 (11)	1 (11)	0
	Total (n=51)	9 (18)	30 (59)	12 (24)	0
Information about STIs/infection (%)	iOS (n=15)	4 (27)	8 (53)	2 (20)	0
	Android (n=49)	3 (6)	29 (59)	17 (35)	0
	Both (n=14)	8 (57)	5 (36)	1 (7)	0
	Total (n=78)	15 (19)	42 (54)	21 (27)	0
Management (%)	iOS (n=10)	2 (20)	6 (60)	1 (10)	1 (10)
	Android (n=42)	0	27 (64)	15 (36)	0
	Both (n=9)	8 (89)	1 (11)	0	0
	Total (n=61)	10 (16)	34 (56)	16 (26)	1 (2)
Partner notification (%)	iOS (n=4)	1 (25)	3 (75)	0	0
	Android (n=19)	2 (11)	15 (79)	2 (11)	0
	Both	3 (43)	4 (57)	0	0
	Total (n=30)	6 (20)	22 (73)	2 (7)	0
ePrescribing (%)	iOS	0	0	0	0
	Android	0	0	0	0
	Both	0	0	0	0
	Total	0	0	0	0
Contraception (%)	iOS (n=11)	2 (18)	7 (64)	2 (18)	0
	Android (n=8)	1 (13)	6 (75)	1 (13)	0
	Both(n=11)	10 (91)	1 (9)	0	0
	Total (n=30)	13 (42)	14 (47)	3 (10)	0
Service provision (%)	iOS (n=9)	6 (67)	2 (22)	1 (11)	0
	Android (n=8)	4 (50)	3 (38)	1 (13)	0
	Both (n=12)	11 (92)	1 (8)	0	0
	Total (n=29)	21 (72)	6 (21)	4 (14)	0

Table 41 continued

STI/infection	Platform	Completely accurate	Majority accurate	Partially Accurate	Not accurate
Chlamydia (%)	iOS (n=11)	2 (18)	8 (73)	1 (9)	0
	Android (n=14)	0	12 (86)	2 (14)	0
	Both (n=12)	8 (67)	3 (25)	1 (8)	0
	Total (n=37)	10 (27)	23 (62)	4 (11)	0
Gonorrhoea (%)	iOS (n=11)	3 (27)	7 (64)	1 (9)	0
	Android (n=14)	0	12 (86)	2 (14)	0
	Both (n=12)	7 (58)	5 (41)	0	0
	Total (n=37)	10 (27)	24 (65)	3 (8)	0
Syphilis (%)	iOS (n=11)	3 (27)	6 (55)	2 (18)	0
	Android (n=12)	1 (8)	10 (83)	1 (8)	0
	Both (n=11)	8 (73)	2 (18)	2 (18)	0
	Total (n=34)	12 (35)	18 (53)	4 (12)	0
Genital warts (%)	iOS (n=10)	1 (10)	9 (90)	0	0
	Android (n=15)	0	8 (53)	7 (47)	0
	Both (n=11)	7 (64)	4 (36)	0	0
	Total (n=36)	8 (22)	21 (58)	7 (19)	0
HPV (%)	iOS (n=10)	2 (20)	7 (70)	1 (10)	0
	Android (n=15)	0	6 (40)	9 (60)	0
	Both (n=11)	4 (36)	7 (64)	0	0
	Total (n=36)	6 (17)	20 (57)	10 (27)	0
Genital herpes (%)	iOS (n=11)	3 (27)	7 (64)	1 (9)	0
	Android (n=24)	0	12 (50)	12 (50)	0
	Both (n=12)	7 (58)	4 (33)	1 (8)	0
	Total (n=47)	10 (21)	23 (49)	14 (30)	0
Pubic lice (%)	iOS (n=7)	3 (43)	4 (57)	0	0
	Android (n=8)	0	8 (100)	0	0
	Both (n=8)	7 (88)	1 (13)	0	0
	Total	10 (43)	13 (57)	0	0

STI/infection	Platform	Completely accurate	Majority accurate	Partially Accurate	Not accurate
Trichomonas vaginalis (%)	iOS (n=7)	1 (14)	5 (71)	1 (14)	0
	Android (n=10)	0	8 (80)	2 (20)	0
	Both (n=7)	5 (71)	2 (29)	0	0
	Total (n=24)	6 (25)	15 (63)	3 (13)	0
Vaginal candidiasis	iOS (n=9)	2 (22)	4 (44)	3 (33)	0
	Android (n=8)	1 (13)	2 (26)	5 (63)	0
	Both (n=6)	3 (50)	1 (17)	2 (33)	0
	Total (n=23)	6 (26)	7 (30)	10 (43)	0
Bacterial vaginosis	iOS (n=2)	1 (50)	1 (50)	0	0
	Android (n=11)	0	6 (55)	5 (45)	0
	Both (n=5)	2 (40)	2 (40)	1 (20)	0
	Total (n=18)	3 (17)	9 (50)	6 (33)	0
NSU	iOS (n=3)	1 (33)	2 (67)	0	0
	Android (n=5)	0	4 (80)	1 (20)	0
	Both (n=5)	2 (40)	1 (20)	2 (40)	0
	Total	3 (23)	7 (54)	6 (46)	0
PID	iOS (n=4)	1 (25)	3 (75)	0	0
	Android (n=15)	1 (7)	13 (87)	1 (7)	0
	Both (n=4)	2 (50)	2 (50)	0	0
	Total (n=23)	4 (17)	18 (78)	1 (4)	0
Epididymitis	iOS (n=20)	2 (67)	1 (33)	0	0
	Android (n=2)	1 (50)	1 (50)	0	0
	Both (n=1)	1 (100)	0	0	0
	Total (n=6)	4 (67)	2 (33)	0	0
Overall	iOS (n=20)	6 (30)	11 (55)	3 (15)	0
	Android (n=52)	0	28 (54)	24 (46)	0
	Both (n=15)	7 (47)	7 (47)	1 (7)	0
	Total (n=87)	13 (15)	46 (53)	28 (32)	0

Table 42: Summary of accuracy scores

Platform	App ID	Title of App	Sum of content type accuracy scores	Content type accuracy %	Sum of STI/infection accuracy scores	STI/infection accuracy %	Overall Accuracy score	Overall Accuracy %
iOS	i1	Sexually transmitted disease (STD) triage	13	97	15	97	28	97
iOS	i2	STD Guide	37	45	39	40	76	43
iOS	i3	STD Glossary	28	77	36	83	64	80
iOS	i4	iCondom Coventry	2	100	-	-	-	-
iOS	i5	99 - The Talk	13	97	27	99	40	98
iOS	i6	Safer Sex	8	67	-	-	-	-
iOS	i7	STD411	10	100	8	100	18	100
iOS	i8	Private Girl Tips	17	76	29	80	46	
iOS	i9	SWISH APP	2	100	-	-	-	
iOS	i10	Sex Health Dictionary & Sexual Health Video Lessons	17	87	35	80	52	83
iOS	i11	Safesex Guide	16	67	46	69	62	68
iOS	i12	Safe sex	8	67	-	-	-	-
iOS	i13	SafeSex101	20	85	32	75	52	80
iOS	i14	SAFE - Safety Awareness for Everyone	24	76	21	75	45	75
iOS	i15	iSex - Sex Education and Terminology	12	67	31	81	43	74
iOS	i16	Girls's guide for sex myths	10	77	-	-	-	-
iOS	i17	CaSH 2 U	4	100	-	-	-	-
iOS	i18	Pap Test Lite	16	67	4	67	20	67
iOS	i19	Natural Yeast Infection Solutions	16	44	6	37	22	39
iOS	i20	A woman's guide to yeast infections	22	60	6	37	28	47

Table 42: Summary of accuracy scores

Platform	App ID	Title of App	Sum of content type accuracy scores	Content type accuracy %	Sum of STI/infection accuracy scores	STI/infection accuracy %	Overall Accuracy score	Overall Accuracy %
Android	a1	Abnormal Vaginal Discharge	10	78	18	63	28	67
Android	a2	About Herpes Simplex Infection	12	67	6	33	18	58
Android	a3	After Sex	23	79	35	80	58	80
Android	a4	Bacterial Vaginosis Disease	15	83	6	83	21	83
Android	a5	Bacterial Vaginosis Guide	26	47	8	67	34	52
Android	a6	Bacterial Vaginosis Treatments	10	50	9	58	19	54
Android	a7	Chlamydia Disease and Symptoms	17	86	9	83	26	85
Android	a8	Chlamydia Know it Prevent it Treat it	16	67	6	83	22	72
Android	a9	Deadly Herpes Virus Acyclovir	16	67	6	33	22	60
Android	a10	Female Herpes	24	67	3	83	27	69
Android	a11	Genital herpes guide	14	56	5	50	19	54
Android	a12	Genital Herpes Information	19	81	3	83	22	81
Android	a13	Genital Herpes Treatment	24	53	5	50	29	53
Android	a14	Genital Herpes Treatment	25	50	5	50	30	50
Android	a15	Genital Warts Guide	13	61	11	43	24	53
Android	a16	Genital Warts Guide	12	67	10	50	22	60
Android	a17	Genital warts info	23	38	12	33	35	36
Android	a18	Genital Warts Info	22	47	12	33	34	39
Android	a19	Genital Warts Info	23	38	12	33	35	36
Android	a20	Genital Warts Information	18	83	6	83	24	83
Android	a21	Get Rid of Bacterial Vaginosis	12	33	6	33	18	33
Android	a22	Get Rid of Yeast Infection Now !	12	33	6	33	18	33
Android	a23	Gonorrhea Disease & Symptoms	17	86	7	95	24	89
Android	a24	Guide to STDs	23	57	44	64	67	64
Android	a25	Herpes Knowledge	10	50	5	50	15	50
Android	a26	Herpes Lupus Psoriasis Eczema	11	97	3	83	14	94

Table 42: Summary of accuracy scores

Platform	App ID	Title of App	Sum of content type accuracy scores	Content type accuracy %	Sum of STI/infection accuracy scores	STI/infection accuracy %	Overall Accuracy score	Overall Accuracy %
Android	a27	Herpes Treatment	24	67	5	50	29	64
Android	a28	HPV Infection Information	15	83	6	83	21	83
Android	a29	iGirl	21	83	34	77	55	80
Android	a30	Knowledge of Herpes	11	42	5	50	16	44
Android	a31	No Worries	23	85	18	83	41	85
Android	a32	NORISKS	2	100	-	-	-	-
Android	a33	Painful urination in men	16	80	20	67	36	73
Android	a34	Pelvic inflammatory disease	21	83	9	83	30	83
Android	a35	Protection - Sex	17	93	21	75	38	85
Android	a36	Pubic Lice Crabs Information	16	67	3	83	19	81
Android	a37	SAFE	22	72	21	75	43	74
Android	a38	Safer sex	8	89	-	-	-	-
Android	a39	Samedaydoctor - STD Testing	11	72	26	79	37	80
Android	a40	Sexual Education	14	56	15	63	29	64
Android	a41	Sexually transmitted Stds	21	75	21	75	42	75
Android	a42	Sheffield SH	9	83	-	-	-	-
Android	a43	STD glossary	16	80	42	70	58	73
Android	a44	Stop Vaginal Odor	28	40	35	72	63	38
Android	a45	Syphilis Disease and Symptoms	18	83	3	83	21	83
Android	a46	The Big Book - Symptoms of STD	12	83	31	82	43	82
Android	a47	The Sex Guide	18	73	-	-	-	-
Android	a48	Treat Genital Herpes Naturally	19	63	5	50	24	67
Android	a49	Trichomoniasis information	18	83	3	83	21	83
Android	a50	UCT Safe Sex	6	83	-	-	-	-
Android	a51	Yeast Infection	5	50	5	50	10	50
Android	a52	Yeast Infection Home Remedy	19	54	6	33	25	50

Table 42: Summary of accuracy scores

Platform	App ID	Title of App	Sum of content type accuracy scores	Content type accuracy %	Sum of STI/infection accuracy scores	STI/infection accuracy %	Overall Accuracy score	Overall Accuracy %
Both	b1	C&SH Somerset	19	94	18	96	37	95
Both	b2	Conifer Sex Health	18	96	19	98	37	97
Both	b3	FPA - Find a Clinic	16	100	26	100	42	100
Both	b4	FREE 2 B ME	13	90	16	89	29	89
Both	b5	Get Them Tested	13	97	19	94	32	95
Both	b6	Kent C Card	10	92	0	-	-	-
Both	b7	KIS-SK	6	83	0	-	-	-
Both	b8	KYSH - Know Your Sexual Health	9	96	12	100	21	98
Both	b9	My Sex Doctor	14	100	32	89	46	94
Both	b10	NeedTayKnow	14	100	12	100	26	100
Both	b11	SexPositive	9	96	17	86	26	91
Both	b12	Sexual Health Guide	17	98	23	91	40	94
Both	b13	Sexual Health Liverpool	10	100	3	83	13	92
Both	b14	Your rapid diagnosis STD	24	76	43	68	67	72
Both	b15	Your Choice Your Voice (YCVV)	10	100	44	72	54	86

Table 43: Median accuracy percentage

Platform	Content type accuracy % median (IQR)	STI/infection accuracy % median (IQR)	Overall Accuracy % median (IQR)
iOS	76.5 (30)	77.5 (16)	76.7 (16.7)
Android	69.5 (29.6)	73.5 (33.3)	66.7 (29.7)
Both	95.9 (8.3)	90.8 (12)	94.6 (6)
Total	77 (27.7)	81 (36)	75.2 (30.5)

6 DISCUSSION

6.1 MAIN FINDINGS

This is the first review of the content and accuracy of apps to assist people concerned about STIs and genital infections.

Number of apps and search findings

Although in the initial search for apps that contained information on sexual health I found thousands of hits, only a small proportion of these were eligible when taking the perspective of a member of the public seeking information on STIs and genital infections. The majority of the search terms when put in to Google play came up with 250 hits for each term. We found, when searching through these hits, that eligible apps were dispersed throughout these 250 hits, and it was necessary to search through all 250 in order to find all relevant apps. Searching using the same search terms in the iOS store found similar issues however there were fewer hits per search term, and fewer eligible apps. Even once the researchers had distilled the eligible apps by applying the eligibility criteria to the developer's description of the app, once the apps were downloaded and a full evaluation was conducted, 35% of the apps were found to be ineligible.

It is therefore difficult for a member of general public who is looking for an app on STIs and genital infections to search and find an app that meets their needs, irrespective of whether that app is comprehensive and accurate.

Basic details and additional information

It was not possible to discern in which country the majority of apps were developed. This has implications in terms of interpreting the content and accuracy of the information provided as different countries have different guidelines. For example, within the UK it is standard practice for cervical cytology to be performed on a three yearly basis for all women aged between 25

and 55 years of age, whereas in other countries these guidelines differ. In addition, definitions and terminology differ between countries, with latent syphilis being defined as two years post-infection in the UK, as opposed to one year post-infection in the US, and cervical cytology being referred to as 'pap smear' in the US whereas in the UK it is normally referred to as just 'smear' or 'cervical cytology/smear'. Brand names of medications also differ between countries, with at least one app referring to a drug by its brand name in that country which is different to the brand name of the drug in the UK. All of these can potentially cause confusion amongst consumers looking for information.

Only 51% of apps had been updated within the past year and therefore almost half could contain out of date information.

Age restriction criteria differed between platforms with iOS having an age cut off and Google play describing the age restriction as different levels of maturity. It is not clear what the maturity rating for Android apps actually means and how it is decided.

HON criteria

Only 1 app met more than 50% of the HON criteria, with 71% meeting five or less. No apps contained references or documentation of where the information came from; this means that it is impossible for people to assess the reliability of the information.

Range of coverage

Content coverage ranged from apps that only provided information on one content parameter (e.g. testing) and no information on STIs or genital infections, to apps that covered multiple content parameters and multiple STIs and genital infections. Apps available in both platforms were more comprehensive in terms of the number of content parameters covered and number of STI and genital infections covered.

Comprehensiveness of content

Compared to patient information webpages provided by FPA, NHS Choices and BASHH, the majority of apps provided incomplete information on the parameters that they covered, although there was wide variability in terms of parameters covered, apps and platforms assessed. There was particularly poor coverage of safe sex and partner notification, which is of concern from a public health perspective.

Of concern, only 18% of apps provided fully comprehensive information on the STI/genital infections on which they focussed. Despite the prevalence and incidence of genital chlamydia, and the presence of a national screening programme for 16-24 year olds, only 43% provided any sort of information on this infection, with the majority of these providing only partially comprehensive information.

Accuracy of content

As with coverage and comprehensiveness of content, accuracy of content was highly variable between apps and between platforms. Only a small proportion of apps were found to contain completely accurate information, whereas 32% contained only partially accurate (i.e. errors in more than one aspect of the information or more than two minor errors).

Potentially harmful content

There was a large degree of variability of content and accuracy between apps and between different platforms with no quality accredited system to enable the public to determine which apps to trust.

Although none of the apps assessed actually make a clinical diagnosis, with the exception of “STD triage”, and none of them would be categorised as medical devices, the inaccurate information provided, particularly related to management of the condition, means that some of them could be deleterious to health, e.g. some of the managements suggested for vaginal candidiasis and bacterial vaginosis. Perhaps more importantly, some of the apps are potentially psychologically damaging. The psychological effects of infections such as HPV and

HSV frequently outweigh the physical effects, and this has been backed up by the literature (212-216). Several of the apps reviewed that contained information on these infections were both condemning and scaremongering.

However, some apps provided excellent information on one of both of these infections, e.g. Genital Herpes Information by Naster Solomon.

6.2 FINDINGS OF OTHER STUDIES

Muessig et al conducted a review of the characteristics and content of HIV and STI prevention and care apps. They found 55 apps that fitted their inclusion criteria. Of these, 49% had been updated within the previous 12 months. 36% of eligible apps contained information on STI testing, as opposed to 64% of apps in our review. Likewise, a far higher proportion (79%) of the apps we reviewed provided information on safe sex, with Muessig et al finding only 24% of the apps in their reviewed contained information on this parameter. Muessig et al did not assess comprehensiveness and accuracy of the apps. (64)

Of the 10 apps that have been approved by NHS Choices health apps library under the sexual health section, only four concern STIs (one of which we found to be non-functioning); five are related to specifically to HIV and one to alcohol(210). It is difficult to make an assessment as to how up-to-date this information is with the NHS Choices health apps library neither having a creation date nor an updated date on its web pages. Furthermore, there is no mention as to when the individual apps were approved. The HON Code of Conduct for medical and health Web sites (HONcode) recommends that 'all medical content has to have a specific date of creation and a last modification date'(217). The HONcode is provided by a non-government organisation with the aim of addressing the reliability and credibility of medical and health information on the internet(209). Although it is not mandatory, if a NHS-backed website that hosts the health apps library has failed to meet this basic requirement, it brings in to question the validity and usefulness of the recommendations it is providing. Knowledge and information

within the medical field develops and changes frequently and it is important for users to know when the information on both the NHS choices health apps website and the individual apps were last reviewed and updated.

Within other fields of medicine

Fifty percent of apps for the prevention, detection and management of cancer were free to download (review conducted 2012). Few incorporated 'features that could facilitate communication with the health care team' and the reviewers felt that the apps 'did not take advantage of the smartphone's technical capability' (218).

As found in this review, a significant proportion of medical apps fail to provide information on authorship, references, and are not updated on a regular basis (64;66;76). In addition, only a minority of apps have input from an appropriately qualified healthcare professional (66;76). Sunyaev et al examined the proportion of mobile medical apps which had privacy policies, finding that only 30.5% (183) of the 600 apps reviewed had privacy policies. These also found that 66.1% of these policies were not specifically relevant to the app(219).

Huckvale et al found similar issues to us in terms of limited comprehensiveness and breadth of information provided in their systematic review of apps for self-management of asthma(66). Arnhold et al, although not directly assessing content, found in their review of apps for people with diabetes that the majority of apps were limited in terms of the number of functions that they performed and that the apps offered similar functionality(201).

6.3 STRENGTHS/WEAKNESS/LIMITATIONS

Although I have designed and conducted a comprehensive review, it has not been possible to eliminate the subjective element. Because of the need for more than one person to conduct the review, the length of time it took to search for and evaluate each app, and the timing of the review, it was necessary to have three other researchers involved at different points in time. This meant that the subjectivity is likely to be increased, whilst potentially reducing the

accuracy of the scoring of individual apps and the ability to compare these apps. Because of the way I designed and conducted the review, I chose not to calculate the kappa coefficient of agreement between researchers. In addition, I did not use an independent third reviewer to resolve any differences in scores for the apps which could have led to significant bias.

In the future I would choose to conduct the review with one or two other suitably qualified researchers, who reviewed all of the apps and who did not change during the review process. I would use an independent third reviewer to resolve any differences in scores. By doing so I could also calculate the kappa coefficient of agreement between the researchers meaningfully.

Because of the scope of the review, and following the findings of the initial phase one search process, it was necessary to employ stringent inclusion and exclusion criteria. Therefore, it is possible that we have missed apps that should have been included within this review.

As noted by Lewis in his paper on self-certification of medical apps(209), this review was also limited by the need to assess a broad range of apps that focussed on different aspects of sexual health and which had very different interfaces. This meant that any direct comparison between individual apps was impossible and that the parameters had to be kept broad.

Ten apps were excluded because they required a subscription or a username and password. They either required one to have attended a clinic before being able to access the app or asked for personal information including contact details. As the researchers were using their own personal smartphones to access the apps, the decision was made to exclude these apps. This could have led to a significant bias through excluding either higher or lower quality apps.

However, this is a large review that has been rigorously conducted, and includes STI and genital infection apps from the main mobile phone platforms and from a wide range of countries.

6.4 STRENGTHS/WEAKNESSES IN RELATION TO OTHER STUDIES

Powell et al criticised the quality of published reviews of mobile medical apps, suggesting that many of them have failed to perform a systematic, evidence-based assessment of the apps in question(220). I have adapted and developed a framework for reviewing mobile medical apps that is timely and comprehensive. Whilst it is specific to sexual health, this framework could be easily amended to meet the needs of other specialities.

It is difficult for any review of this magnitude to be conducted, analysed and written up within a timeframe that ensures that it isn't out of date by the time it is published(209). However, although the assessment of an individual app may not be completely accurate at the time of publishing, the overall findings of the survey can be helpful in providing evidence on the quality of mobile medical apps and informing the need for changes in the regulation and accreditation of apps.

6.5 MEANING AND IMPLICATIONS

Sexual health is still a stigmatised area and therefore people maybe more likely to seek information online. The fact that a high proportion of apps contain inaccurate information is of great concern.

It is clear that accuracy and quality of currently available mobile medical apps is highly variable and at the moment there is no easy way for the consumer to recognise which apps to trust and which apps to avoid.

The US Food and Drug Administration (FDA) have taken the approach of only attempting to regulate those mobile apps that they define as medical devices. They refer to these apps as medical mobile apps and , similar to the MHRAs classification of medical devices(221), categorise medical mobile apps as 'low risk', 'moderate risk' or 'high risk'. Their guidance only applies to those apps that are classified as 'moderate' or 'high risk'. The vast majority of

available mobile medical apps do not fall into these categories and therefore remain unregulated (222;223).

In the US, Happtique Health App Certification Standards provided certification for those apps available in the US that met their standards on a variety of criteria including content quality, usability, connectivity, security and privacy (205;209). However, this process was suspended towards the end of 2013 following the discovery that several apps that had previously received certification contained issues with security(224). This, along with other reasons discussed below, has made several authors question the feasibility and usefulness of accreditation of medical and health apps (205;224-226). It is a time-expensive process, with Happtique taking 18 months to certify 16 apps(224). In addition, with the number and diverse origin of available apps, any certification process is going to have to be voluntary and is likely to only ever be taken up by a small proportion of the market(225). There is also a fear that regulation will limit innovation through unnecessary bureaucracy, increased cost and delay in time to market (226;227).

Instead Boulos et al and Chan and Misra argue that we should be focussing on educating consumers on how to assess whether an app is a reliable source of information, and recommending (or even prescribing) those apps that are known to be accurate and accessible(205;225). They do not discuss how this can actually be achieved, and, as with regulation, education in terms of apps may need to differ depending on who the app is targeting and an assessment of the potential harm from individual apps.

Implications for the eSTI² Chlamydia Online Clinical Care Pathway

Although the first point of access for young people looking to find information on sexual health is the internet, qualitative research conducted by other researchers within the eSTI² consortium suggests that young people prefer to access this information via a web application than a native app (181;228). Reasons for this include concerns with regards to privacy, with the fear that a friend or parent will see that they have a sexual health app on their

phone(181;228). It is acknowledged that young people are faster to adopt but also potentially faster to reject new technology(6). However, Helsper raises the potential implications of assuming that young people are digital experts, are intrinsically better at filtering information and aware of the risks associated with the internet(229).

The findings from the qualitative research (181;228), along with the large variability in terms of coverage, comprehensiveness and accuracy of apps, with no way for people to easily identify apps that are relevant and accurate, found by this review led us to decide to develop a web application as opposed to a native app for the Chlamydia-OCCP. Other factors that led us to make this decision included the complexity of the pathway which, although designed so that people could use it on their smartphone, would be easier to complete on a larger screen (i.e. a tablet, laptop or PC), and allowing people that had mobile phones which were not smartphones to access the pathway.

6.6 RECOMMENDATIONS

As well as assessing whether an app is high risk in terms of potential physical harm, psychological harm should also be taken in to consideration, particularly in the context of sexual health apps.

A more transparent accreditation process by NHS Choices, preferably with the involvement of the British Association of Sexual Health and HIV (BASHH), with clear guidelines on what needs to be achieved could be a useful way forward and then publicising this.

However, I do not believe it will be possible, and is perhaps not necessary, to regulate all sexual health apps. Instead, I support Boulos et al's argument that educating the consumer is more important and feasible. Signposting people to apps that have been accredited or come from a reputable source is a priority.

6.7 UNANSWERED QUESTIONS AND FUTURE RESEARCH

In terms of sexual health, the global diffusion and dissemination of smart phones has been advocated by Swendeman and Rotheram-Borus as a method of delivering interventions aimed at STI prevention and support(230). Nearly five years after their paper was published, we are still a long way from attaining this goal with this review showing that currently available apps are highly variable in coverage, comprehensiveness and accuracy.

I chose to only focus on apps that are designed for the general public and cover sexual health (excluding HIV). There haven't been any reviews conducted that examine the content and accuracy of sexual health apps designed for health care professionals, or those that cover HIV. In addition, further research is needed to examine the efficacy of these apps in increasing knowledge and bring about behaviour change.

Concerns related to mobile medical apps as a whole include the potential for breach of patient confidentiality(76;231), lack of validated medical information (70;200;218;232), errors produced by faulty clinical decision making apps or calculators(76), and lack of evidence of mobile medical app efficacy to deliver health behaviour changes and improve patient outcomes (71;75;218;227;233-235;235). Pandey et al, in their review of apps for cancer, found a significant difference in scientific validity between apps aimed at the general population when compared to those developed for healthcare professionals(200).

Buijink et al state 'the field of medical apps is currently one of the most dynamic in medicine, with real potential to change the way evidence-based healthcare is delivered in the future'(76). Whilst true, we are unlikely to see this potential reached, at least in terms of medical apps designed for patients and the public, unless there is clear guidance in the UK as to which apps need accreditation before being made freely available, and we find a way of guiding users on how to assess the reliability of the app they are looking at or directing them towards those apps that have undergone voluntary or mandatory certification.

Chapter 3: Review of electronic prescribing in the UK to inform the design of the Chlamydia Online Clinical Care Pathway

This chapter is composed of the following components:

1. Rationale
2. Background
3. Methods
4. Results
5. Discussion
6. ePrescribing within the eSTI² Chlamydia Online Clinical Care Pathway

1. RATIONALE

As part of my routine Queen Mary University of London work, I conducted a review of legal, regulatory, organisational, ethical and perceptual barriers pertinent to the introduction of a Sexual Health online clinical care pathway into the NHS. Whilst conducting this it became apparent that, despite the volume of literature on electronic prescribing (39), there have been no reviews on electronic prescribing in the UK and that there were particular difficulties surrounding the introduction of an electronic prescription service which bridges primary and secondary care.

I therefore chose to conduct a comprehensive review of electronic prescribing in the UK. This would enable me to explore options and solutions for the introduction of an electronic

prescribing service, using an automated online clinical consultation to assess safety and appropriateness of treatment, for azithromycin 1g stat to patients diagnosed with chlamydia which could be issued in secondary care and dispensed in a community pharmacy.

2. BACKGROUND

2.1 DEFINITIONS

Prescriptions, whether paper or electronic, are a method whereby a physician, or a suitably qualified healthcare professional, enables a patient, or a patient's representative, to collect the medication that the healthcare professional has recommended from an onsite or external dispensary or pharmacy.

Electronic prescribing, defined as 'the utilisation of electronic systems to facilitate and enhance the communication of a prescription or medicine order, aiding the choice, administration and supply of a medicine through knowledge and decision support and providing a robust audit trail for the entire medicines use process'(89) is a key part of the larger eHealth landscape.

eHealth, defined as the utilisation of evolving information and communication technology to develop and improve the organisation and delivery of health services and healthcare(11;12), eHealth has assumed increasing importance within the NHS over the past 20 years.

Computerized Provider Order Entry systems: Outside the UK, electronic prescribing systems are known as computerized provider (previously physician) order entry systems (CPOEs). CPOEs have been defined by Kaushal et al as 'a variety of computer-based systems that share the common features of automating the medication ordering process and that ensure standardized, legible, and complete orders'(236). There are subtle differences between electronic prescribing systems and CPOE systems. However, for the purposes of this chapter, I

have chosen to use electronic prescribing to describe electronic prescribing systems, and for this to be synonymous with CPOE systems.

Clinical Decisions Support Systems are defined as “any electronic or non-electronic system designed to aid directly in clinical decision making, in which characteristics of individual patients are used to generate patient-specific assessments or recommendations”(237). The majority of electronic prescribing systems incorporate clinical decision support systems which vary in complexity from providing basic advice about drug dosage and mode of delivery to the ability to check for drug allergies, drug-drug interactions, laboratory results (including adjusting for renal impairment), and relevant guidelines(30;236).

The NHS *Spine* is the ‘essential national infrastructure that stores patient information and enables electronic messaging’(238). The Spine ‘holds the demographic information of 80 million people, as well as controlling the messaging between key applications used in the delivery of patient care, for example, the Electronic Prescription Service, Summary Care Record and Choose and Book’(238). The contract for the Spine was due to expire in June 2013(239). However, the *Health and Social Care Information Centre* concluded that it was imperative for this service to continue. This was accomplished, with an extension of contract which covered the transition to the new ‘Spine 2’ project(240). The new Spine infrastructure (‘Spine 2’) was implemented on 23rd and 24th August 2014(241).

Grey literature is defined by Khoja et al as ‘any literature that is not published in academic peer-reviewed journals and is not available through indexed databases for review’(242).

2.2 POLITICAL MILIEU

There has been growing political influence on development of eHealth, visible since 1998 with the Department of Health’s strategy document *Information for Health*(83). This pledged lifelong electronic health records for patients, along with 24 hour online access to medical records and best practice guidance for all NHS clinicians(5;83).This theme has continued,

including the more recently published strategies and consultations: *Building the Information Core: Implementing the NHS Plan*(243);*Delivering 21st century IT support for the NHS: national strategic programme*(87); *Better information, better choices, better health: Putting information at the centre of health*(88); *Liberating the NHS: An Information Revolution*(85); *Keeping your online health and social care records safe and secure*(244); *The Power of Information: putting us all in charge of the health and care information we need*(84); *Safer Hospitals, Safer Wards*(89).

The NHS *National Programme for Information Technology*, launched in October 2002, aimed to establish the infrastructure and setting to deliver a comprehensive electronic health record (NHS Care Records Service) for patients utilising an national network (N3) and database (the Spine), an integrated electronic prescription service and an electronic hospital appointment service (Choose and Book)(5). Despite an £11.4 billion programme of investment, it was fraught with difficulties and received negative reportage (245-249).

In 2004 the Department of Health, as part of its reconfiguration of Arm's Length Bodies, created NHS *Connecting for Health*. This new organisation was given responsibility for both delivering the *National Programme for Information Technology* and managing the information technology (IT) component of the NHS Information Authority(5;250). In 2012, as part of the Health and Social Care Act(251), it was announced that *Connecting for Health* would be incorporated into the newly formed *Health and Social Care Information Centre*. Despite the troubles associated with the *National Programme for Information Technology*, the Electronic Health Record (EHR) systems in use in General Practice in the UK have received both national and international recognition as an example of successful implementation of a National EHR system(246;252).

2.3 PROFESSIONAL REGULATORS

In 2009, the General Medical Council commissioned an in depth investigation exploring the type of prescribing errors made by Foundation Year 1 (new qualified) doctors in the UK, relating this to their medical education, in order to make 'evidence-based recommendations'. The research found that there was an error rate of 8.9% in the 124,260 medication orders that were reviewed(253). Recommendations were made but these have been criticised for lacking an evidence base and for not considering systems that have worked in other countries or electronic prescribing as a solution (254-257).

Motulsky et al, in their review of second-generation electronic prescribing, highlight the fact that there appear to be no standards on communication in electronic prescribing, with heterogeneity being the rule rather than the exception(258). In addition, they failed to find a study that looked at process security or process quality(258).

2.4 CURRENT STATE OF PLAY

Electronic prescribing has been introduced into both primary and secondary care within the UK. General practice and hospitals have been treated as separate entities and the approach taken in both cases has been markedly different, with secondary care lagging behind primary(249). For the purposes of this review, I have used the terms primary care, community and general practice, and secondary care and hospitals, synonymously.

3. METHODS

I conducted a comprehensive literature search on electronic prescribing, which was initially conducted in the medical literature and then expanded to include grey literature. I independently developed the following method for approaching this type of disparate literature which needed to included policy, legislation, regulations, trials and other literature. I

have described my methodology employing the structure described by Greenhalgh and Peacock(259) (which divided it into protocol driven search, snowballing, and personal knowledge). However, I found that belatedly having completed the work using similar methodology which I devised independently.

3.1 PROTOCOL DRIVEN SEARCH

Using NHS Evidence, I performed an electronic search of MEDLINE, EMBASE and the Cochrane Library.

The search was conducted of articles published between 1993 and 2013, as the first electronic prescribing systems were introduced 20 years ago, using NHS Evidence database thesaurus terms and free text search terms. Table 44 below describes the NHS Evidence database thesaurus terms used.

Table 44: NHS Evidence database thesaurus terms for ePrescribing literature review

Drug therapy, computer assisted	Legislation, medical
Electronic prescribing	Medical order entry systems
England	Medication errors
Great Britain	Organization and administration
Inappropriate prescribing	Pharmaceutical services, online
Jurisprudence	Reference standards
Legislation as topic	Utilization review

Appendix II illustrates the search strategy I conducted using the above NHS Evidence thesaurus terms and free text. I searched official Government, NHS and professional association websites, including existing professional guidance (summarised in Table 45 below).

Table 45: Government, NHS & professional association websites searched

Type of website	URL
Government	http://www.legislation.gov.uk/; http://www.hscic.gov.uk/;
NHS	http://www.nhsbsa.nhs.uk/; http://webarchive.nationalarchives.gov.uk/20130502102046/http://www.connectingforhealth.nhs.uk/ https://www.england.nhs.uk/
Professional	http://www.gmc-uk.org/ http://psnc.org.uk/ http://www.rpharms.com/home/home.asp

I then searched Google and Google Scholar to capture both medical and grey literature that had been missed in the above searches.

3.2 'SNOWBALLING'

I used reference and citation tracking to widen the scope of relevant sources found.

3.3 PERSONAL KNOWLEDGE

This included articles that I found whilst searching for other topics (serendipitous discovery) and personal contacts and academic networks.

4. RESULTS

As mentioned in the introduction, there is a large amount of diverse literature on electronic prescribing, present in both medical and grey literature. I classified relevant literature under two main headings, as this formed a natural subdivision of the literature found in the search: legal and regulatory and organisational.

4.1 LEGAL AND REGULATORY

Table 46 summarises the relevant literature I found on electronic prescribing legislation and regulations.

Table 46: Summary of the relevant literature on the legal and regulatory aspects of electronic prescribing

Ref	First Author/Source	Year published	Source focus	Source type	Findings and Recommendations
1	British National (260)Formulary	2013	BNF November 2013	Guidance	Provides guidance on what details are required on computer issued prescriptions
2	General Medical Council(261)	2013	Good practice in prescribing and managing medicines and devices	Professional guidance	Provides guidance on safe prescribing, including remote prescribing.
3	Legislation.gov.uk (262)	2001	Prescription Only Medicines (Human Use) (Electronic Communication) Order	Legislation	Article 15 of the PoM Order 1997 amended. Permits prescriptions to be transmitted electronically and the use of electronic signatures.
4	Legislation.gov.uk(263)	1997	The Prescription on Medicines (Human Use) Order 1997	Legislation	Provides details of what information prescriptions need to contain
5	Legislation.gov.uk(264)	2013	NHS (Pharmaceutical and Local Pharmaceutical Service) Regulations	Legislation	Updated legislation governing the provision of pharmaceutical services in England. Defines ePrescribing.
6	NHS Business Service Authority (NHS Prescription Services)(265)	2013	Current and Out of Date Prescription Form Versions	Guidance	Summary of current and out of date prescription forms
7	NHS Information Governance(266)	2008	Guidelines on use of encryption to protect person identifiable and sensitive information	Guidance	Provides guidance on the use of encryption to ensure patient confidentiality
8	Pharmaceutical Services Negotiating Committee(267)	2013	Valid Prescription Forms	Guidance	Summary of valid prescription forms

This content can be divided into the following areas:

Prescriptions

The *Prescription Only Medicines (Human Use) Order 1997* states that prescriptions need to contain the following information(263):

Address of the Practitioner
Appropriate date
Title of the Practitioner
Name of patient
Address of patient
If under 12, the age of the patient

With increasing shared responsibility of patient care, the Department of Health released a circular making it clear that in the case of shared care between hospitals and General Practice, the legal responsibility for prescribing is with the doctor who signs the prescription(268)

The recently updated General Medical Council guidelines *Good practice in prescribing and managing medicines and devices* make clear the need to take an adequate drug history, including adverse drug reactions, recent use of medicines including over the counter and illicit drugs, and other medical conditions(261).

There is a natural divide in the UK between hospital and community prescribing. The majority of hospital prescriptions, whether inpatient or outpatient, are dispensed in an onsite inpatient or outpatient hospital pharmacy. Prescriptions generated from General Practice are either dispensed in an onsite dispensary or by a community pharmacy. If a hospital practitioner wishes to write a prescription that will be dispensed in a community pharmacy then they need

to write the prescription on a specific form called a FP10. The Pharmaceutical Services Negotiating Committee (PSNC) provides a list of valid prescription forms(267).

Electronic prescriptions

The 2001 *Prescription Only Medicines (Human Use) (Electronic Communication) Order* permits the use of electronic prescriptions. This includes the electronic form being signed with an electronic signature and dispensed via electronic means. It does not put any restrictions on which service or software is used to enable this(262).

The British National Formulary provides guidance, based on the Joint GP Information Technology Committee recommendations, on what details are required on computer issued prescriptions.

The computer must print out the:

- Date
- Patient's surname
- One forename
- Other initials
- Age (mandatory if <12 or >60 years)
- Address
- The doctor's name at the bottom of the prescription form
- The doctor's surgery address, reference number, and primary care trust, & the surgery telephone number

This guidance has been developed in conjunction with General Practitioners and with first-generation e-prescribing systems (stand-alone systems producing a printed prescription which is handed to the patient or faxed to a pharmacy) in mind. In second-generation e-prescribing systems, where the electronic prescription is transmitted electronically to the 'spine' (the central server), these guidelines are not necessarily fit for purpose. The GMC *Good practice in prescribing and managing medicines and devices* guideline stipulates that the prescribing

doctor's name and GMC number are sufficient when prescribing remotely.(261). Likewise, we as Healthcare professionals (HCPs) are encouraged to minimise the transfer of patient identifiable information, wherever possible, with NHS Information Governance publishing *Guidelines on use of encryption to protect person identifiable and sensitive information* in 2008 (266). This is particularly important in the scenario of electronic transmission of information related to sexual health. It is common practice in Genitourinary Medicine (GUM) and Sexual Health clinics in the UK to use a unique clinic number and date of birth to identify a patient on a written prescription, but this is when using a hospital pharmacy. Whether it would be permitted in a community setting has not been tested. The address is required to identify which Local Authority the patient is from for reimbursement and for surveillance purposes, and only the first four digits of a postcode is required to do this.

In the *Good practice in prescribing and managing medicines and devices* GMC guidelines (2013) there is a specific section on remote prescribing which states that doctors need to be able to obtain the patient's consent for this. This includes providing the patient with information about the proposed treatment, how and when to take the medicine or use a medical device, how long they need to continue it for, and what follow-up, if any, is required. As well as explaining the rationale for using the treatment, any risks or side effects need to be explained along with what to do if the patient suffers an adverse effect or the condition they are being treated for recurs. It then needs to be confirmed that the patient understands the information. The guidance recognises the difficulties of being able to convey this amount of information in a limited amount of time, and suggests involving other HCPs to help with this, as well as using patient information leaflets(261). Section 61 of the *Good practice in prescribing and managing medicines and devices* guidelines (2013) highlights specific details that need to be considered when prescribing remotely. These include the limitations of the method of communication that a clinician is using, whether the patient needs a physical examination or other investigations, and whether the clinician has access to the medical records of the

patient. Where the latter is not available, the patient has not been referred by their GP and one has never met the patient face-to-face then, if prescribing online, a named doctor and GMC number are required on the prescription. The legal responsibility for prescribing will lie with this doctor(261).

Summary of the requirements for information on a prescription

A prescription needs to convey which treatment the patient requires, how it will be applied (e.g. oral, intramuscular), how often it needs to be taken, how long it needs to be taken for, a method by which that patient can be identified, and who is prescribing the medication. In addition, in the UK, there needs to be sufficient information so that the correct local authority can be billed for the prescription. Table 47 below summarises what the various regulatory bodies stipulate should be on a prescription, and illustrates the marked lack of consensus

Table 47: Summary of the information required on a prescription by different regulatory bodies

Requirements	Regulatory bodies					Genitourinary Medicine
	PoM ¹ Order 1997(263)	NHS BSA ²⁽²⁶⁹⁾ (FP10)	PoM Order 2001 (electronic prescribing)(262)	BNF ³ (electronic prescribing)(260)	GMC ⁴ (remote electronic prescribing)(261)	
<i>Details of prescriber</i>	Address of the practitioner	‘HOSPITAL PRESCRIBER’ to be printed at top of form	Address of the practitioner	The Doctor’s name at the bottom of the prescription form	Doctor’s name	Doctor’s name
		Name and initials of Doctor. Hospital Unit name and address. NHS Trust name and code		The Doctor’s surgery address, reference number and primary care trust, and the surgery telephone number	Named Doctor’s GMC number	
	Title of the practitioner		Title of the practitioner			
<i>Date prescribed</i>	Appropriate date		Appropriate date	Date		Date
<i>1st patient identifier</i>	Name of patient	Name of patient (format to be agreed between the user and the system supplier)	Name of patient	Patient’s surname One forename Other initial		Patient’s unique clinic number

Table 47 continued

Requirements	Regulatory bodies					Genitourinary Medicine
	PoM ¹ Order 1997(263)	NHS BSA ² (269) (FP10)	PoM Order 2001 (electronic prescribing)(262)	BNF ³ (electronic prescribing)(260)	GMC ⁴ (remote electronic prescribing)(261)	
2nd patient identifier and billing information	Address of patient	Address of patient	Address of patient	Address of patient		Patient's postcode
<i>Age/Date of birth</i>	If under 12, the age of patient	Age and Date of birth of patient	If under 12, the age of patient	Age (mandatory if <12 or >60 years)		Date of birth
Signature	Yes	Yes	Yes (electronic)	Not stipulated	No	Yes
Details of drug prescribed⁵	Medication generic name, dose, method of administration and length of prescription					

¹ Prescription only Medicines; ² NHS Business Services Authority; ³ British National Formulary; ⁴ General Medical Council; ⁵ with the exception of controlled drugs

Electronic Prescription Service

The NHS (Pharmaceutical and Local Pharmaceutical Service) Regulations 2013(264), which came into effect on 1st April 2013, replaced the National Health Service (Pharmaceutical Services) Regulations 2012 and Chapter 1 of Part 7 of the National Health Service Act 2006, which covers provision of local pharmaceutical services. The 2005 NHS (Pharmaceutical Services) Regulations define, and the 2013 NHS (Pharmaceutical and Local Pharmaceutical Service) regulations continue to define, electronic prescribing as follows:

“electronic prescription” means an electronic prescription form or an electronic repeatable prescription;

“electronic prescription form” means data created in an electronic form for the purpose of ordering a drug or appliance, which:

... is transmitted as an electronic communication to a nominated dispensing contractor by the Electronic Prescription Service’

This has been interpreted as meaning that only the NHS *Electronic Prescription Service (EPS)* can be used to transmit an electronic prescription to a community pharmacy, although there is nothing explicit within these regulations that covers the scenario that we are describing (270).

4.2 ORGANISATIONAL

Table 48 below summaries the literature found on the organisation of electronic prescribing within the NHS in the UK.

Table 48: summary of the literature on the organisation of electronic prescribing in the UK

Ref	First Author/Source	Year published	Country	Source focus	Source type	Findings and Recommendations
1	NHS Connecting for Health(271)	2009	UK	Electronic prescribing in hospitals. Challenges and lessons learned	Report	Hospital prescribing systems need updating and electronic prescribing offers the potential to address current issues. Although a high proportion of GP practices have electronic prescribing, a much smaller proportion hospitals have such systems. There is wide variability of existing hospital electronic prescribing systems. Communication and engagement of the multidisciplinary team are key to implementing a new system.
2	Cornford(249)	2010	UK	Learning lessons from electronic prescribing implementations in secondary care	Review and study	Describes findings from a literature review and questionnaire study conducted to review lessons learned from implementation of electronic prescribing systems in hospitals in the UK. Not many hospitals have comprehensive, hospital-wide electronic prescribing systems, in contrast to the primary care Electronic Prescription Service. Importance of role of senior managers, champions, clinical input and user involvement, the latter of which must be multi-disciplinary. Importance of establishing good communication between the project, software and database teams. Need for rapid transition from piloting to rolling out full system. Consider sustainability and need for resources to develop and adapt the system.

Table 47 continued

Ref	First Author/Source	Year published	Country	Source focus	Source type	Findings and Recommendations
3	NHS England(89)	2013	UK	Safer hospitals, safer wards: achieving an integrated digital care record	Guidance	Discusses benefits of ePrescribing and provides guidance on the different types of systems available and how they can be implemented
4	Cresswell(272)	2013	UK	Investigating and Learning Lessons from Early Experiences of Implementing ePrescribing Systems into NHS Hospitals: A Questionnaire Study	Questionnaire Study	78.7% response rate (85/108 NHS staff). Low rates (18%) of NHS Trusts had implemented electronic prescribing systems. 55% were planning to implement an electronic prescribing system. There was a diverse range of electronic prescribing systems that had been implemented or were planning on being implemented.
5	Ahmed(273)	2013	UK	The Use and Functionality of Electronic Prescribing Systems in English Acute NHS Trusts: A Cross-sectional Survey	Cross-sectional postal survey	61% response rate from chief pharmacists. 70/101 acute NHS hospital trusts had some form of electronic prescribing. 56% of these had more than one type of electronic prescribing system in use, with 60 diverse systems described (40% developed in-house).
6	Health and Social Care Information Centre(239;274)	2013-15	UK	The national provider of information, data and IT systems for health and social care	Online	Superseded NHS Connecting For Health. Detailed description of the Electronic Prescribing System.

Community-based electronic prescribing: Electronic Prescription Service (EPS)

NHS Connecting for Health introduced the *EPS* into primary care in England in 2005 in the format of *EPS* Release 1. With *EPS* release 1, an electronically generated prescription with a barcode on it is printed off by a general practitioner and handed to the patient as a paper prescription. When issued, the *EPS* receives an electronic copy of the information which is accessible to dispensers who have implemented *EPS* Release 1; when they scan the barcode the stored electronic information is automatically retrieved and downloaded on to the dispenser's computer. Those dispensers who are not *EPS* Release 1 enabled can process the prescription in the traditional way(275).

EPS has, in part, been superseded by *EPS* Release 2(270), which confers additional benefits. These include the ability for a patient to nominate a pharmacy from which to collect their prescription, the capability for a pharmacy to download a prescription generated by a GP from 'the spine', the ability for a GP to generate repeat prescriptions and to cancel a prescription online, and for pharmacist reimbursement to occur electronically. Further advantages include the ability to trace whether a patient has collected their prescription from their chosen pharmacy, and to contact patients where it is clinically important to do so. Studies have shown that electronic prescribing *per se* does not improve patient compliance with collecting prescriptions(276) and, in Sweden, the introduction of electronically transmitted prescriptions paradoxically led to an increase in the number of prescriptions not collected at pharmacies(277). However, an electronic system allows healthcare professionals to track who has collected their medication and who has not. This increased visibility of patients' adherence to medication collection allows problems with individual patients to be identified and interventions to be introduced to improve the situation(278). This has had proven success, either as the sole measure taken or as part of a number of interventions to improve adherence and clinical outcomes(279), although an electronic prescription database was found to be inferior to pill counts as a method of detecting non-adherence in Denmark. The main reasons for this was inaccuracies on the database due to erroneous prescription information(280).

The large percentage of GP surgeries with existing electronic health records, provided by a limited number of commercial providers, and overseen by Primary Care Trusts, facilitated the introduction and uptake of *EPS* release 1. In addition, *EPS* Release 1 was inserted into the GP contract and, as mentioned above, legislation for commercial pharmacies. Pharmacies were offered financial incentives for offering *EPS* (281). At this time, smartphones did not exist, with Apple's iPhone first being introduced in 2007(282), and it was difficult conceive that anyone other a GP would send an electronic prescribing to a community pharmacy (281).

EPS Release 2 initially met with limited success, with low levels of uptake reported(270). This may be due, in part, to the complexity of the authorisation which is required by Local Authorities, pharmacies and individual GP surgeries. In addition, new or updated software is required by GP surgeries and pharmacies. Finally, some GP practices have a dispensary on site that they are already electronically transmitting prescriptions to, whilst others may be satisfied with the *EPS* Release 1 system that they are currently using.

As of 13th March 2015, 51% (n=4143) GP practices in the UK were live with *EPS* 2 and 97% (n=11445) of pharmacies were live(283). 84,563,387 Release 2 prescriptions had been sent, with 12,264,876 patients having a community pharmacy nomination(283).

As with any *Health and Social Care Information Centre* service, in order to access this system, NHS staff require a smartcard and personal identification number (PIN)(239). A smartcard is a secure identification card, which is similar to a chip and PIN credit card. It allows individual staff access to patients records to be restricted according to what is appropriate for the role and grade, and allows a record to be kept of who has accessed which records(284). The smartcard and PIN are also used by General Practitioners to generate an electronic signature for the prescription(285). Although a 'prescription token' can be provided to a patient for them

to collect their prescription with, patients do not require one and can simply attend their chosen pharmacy and confirm their identity verbally to collect it(239).

There have been reports of slow download times of electronic prescribing from ‘the spine’ when pharmacists attempt to access prescriptions. When the new Spine system (Spine 2) was introduced in August 2014, batches of prescriptions were blocked because of a prescription validation error, which meant pharmacists were not able to process the prescriptions, and invalid digital signatures were an issue (286).

In addition, patients are required to nominate one pharmacy to which all of their electronic prescribing will be sent. Those patients who have denied their records being uploaded on to the patient demographic service are marked as ‘sensitive’ and are unable to utilise the EPS. The demographics and characteristics of this group of ‘sensitive’ patients are not defined.

The Prescribing Systems Compliance Specification March 2012(287), specifies the functionality required to support the *EPS* in England. It has been written for system suppliers. Users of the EPS are required to interact with the National Care Record Service Spine via the national communications infrastructure (currently known as N3). The National Care Record Service includes the Personal Demographic Service, the Personal Spine Information Service, and Information Governance. A system wishing to use any of the services provided by the National Care Record Service must first be compliant with these core services and all appropriate legislation, regulations, national and international laws related to healthcare systems (288).

Hospital-based electronic prescribing

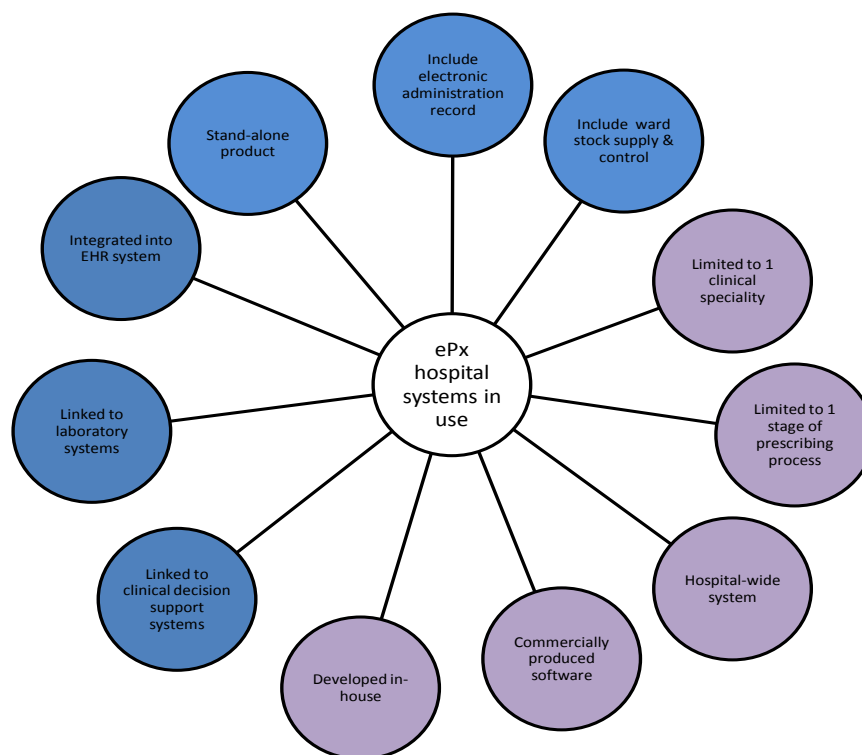
Hospital-based electronic prescribing is very different from electronic prescribing in the community and the latest government strategy, *Safer Hospitals, Safer Wards*, reflects this(89). A £260 million Safer Hospitals, Safer Wards technology fund, administered and delivered by NHS England, was revealed in May 2013. This proposes investing in solutions that are best suited and adapted to individual organisations, as long as they meet national standards in data security and interoperability. The main stipulation is that the primary identifier of individual patients is their NHS number, and NHS England proposes that the widespread transformation to digital healthcare is a ‘focus for innovation and enterprise and a driver of economic growth, particularly among smaller business and their sector organisations’(89).

Chapter 5 of *Safer Hospitals, Safer wards* describes a matrix of five domains (prescribing, medicines management, administration, decision support and interoperability) composed of building blocks which NHS providers can select from to build the system that works best for their situation, rather than stipulating how electronic prescribing should be introduced and which systems should be used. It is emphasised that this matrix is neither prescriptive nor exhaustive and should be interpreted fluidly(89). Although stating the benefits of electronic prescribing it does not reference this or give examples where electronic prescribing has worked in practice.

Electronic prescribing in hospitals in the UK has been implemented in a piecemeal fashion, with individual hospitals using different systems, some of which are incorporated into, or integrated with, electronic health records and clinical decision support systems, and others that are stand-alone. Uptake of electronic prescribing has varied from hospital to hospital, and it is acknowledged that ‘NHS providers in hospitals are at different stages of digital maturity and many still have substantial work to do’(89;249;271). An example of the variety of different

electronic prescribing systems in use, and functionality of these systems, is illustrated in figure 3 below:

Figure 5: Example of the variety of different electronic prescribing systems in use (*adapted from Connecting for Health Electronic prescribing in hospitals; Challenges and lessons learned page 21*)(271)



Some systems are used solely for inpatients, others for outpatients and some for discharge purposes; some systems cover all three areas(271).

In 2011 Ahmed et al conducted a cross-sectional postal survey of the current use of electronic prescribing in acute NHS Hospital Trusts in England (response rate 61% (101 Trusts)). They found that only 13% (13 Trusts) had inpatient electronic prescribing systems in place that were used in both adult medical and surgical wards(273). Their findings confirmed the diversity of type and uptake of electronic prescribing systems, both within hospitals and between hospitals, in use in the NHS in England at the present time(273). Cresswell conducted a questionnaire survey which was targeted at delegates attending a national conference on

implementing electronic prescribing within NHS hospitals in 2012. This was a scoping study designed to give an overview of, and lessons learned from, implementation of electronic prescribing within hospitals in England(272). Although they had a higher response rate than Ahmed et al(273) (79% (85/108 NHS staff attending conference), only 55/168 (33%) Trusts were represented by responders. Cresswell found that a proportion of these trusts had already implemented (18%), were currently implementing (20%) or were planning on implementing (55%) electronic prescribing systems. As with Ahmed et al's(273) findings, the type and spectrum of the electronic prescribing systems in use, or planning to be implemented, was highly variable(272). Both Ahmed et al's and Cresswell's et al studies were subject to responder bias, and Cresswell et al's studies was limited by selection bias as the survey sample were attending a conference on electronic prescribing.

It has been recognised that some departments in hospitals are unique in terms of the implementation of electronic prescribing systems and that they may not suit being integrated into a hospital-wide electronic prescribing system(271). Examples highlighted by Connecting for Health, in their review of the challenges and lessons learned from electronic prescribing in hospitals, include Emergency Departments and Intensive Care Units(271). It would seem logical for GUM clinics to be included as one of the areas where it is more complex due to issues of confidentiality, privacy and stigma, or where it may not be appropriate, to incorporate them into a generalised hospital system.

Traditionally, GUM clinics have been run separately, and frequently differently, to other hospital departments, as discussed in Chapter 1. In terms of prescribing, it is standard practice for doctors and appropriately qualified nurses, to access a range of standard antibiotics, contraception and associated pharmaceutical products from a secure pharmacy stock room within the GUM department. It is up to that individual to check the expiry date on the box, and adhere to local guidelines. In other clinics, the prescription (be it written in the notes, on a prescription or on an electronic system) is 'handed' to a Registered Nurse for that nurse to give

the medication to the patient. The type, or dosage, of medication used in Sexual Health Clinics is often different to those used in other departments (e.g. Azithromycin 1g PO stat; Metronidazole 2g PO stat; Ceftriaxone 500mg I.M. Stat).

5. DISCUSSION

Electronic prescribing has become a common component of eHealth increasingly used in everyday practice by healthcare professionals in the UK. Acknowledged as an important component of eHealth, Black et al, in their systematic overview of the impact of eHealth on the quality and safety of eHealth, found that electronic prescribing was the most commonly studied intervention(39). However, there was large variation in the quality and generalisability of these interventions(39). Study evaluation depends on definition and spectrum of electronic prescribing – i.e. the term electronic prescribing includes everything from a stand-alone system, without a clinical decision support system, that produces a printed paper prescription for a patient to take to a pharmacy, to a sophisticated electronic prescribing system, including a clinical decision support system, where drugs can be prescribed, with an electronic signature, dispensed, repeat prescriptions produced, cost reimbursed and stocks resupplied (249). Cornford et al, in their review of lessons to be learned from the implementation of electronic prescribing systems in Secondary Care in the UK, state ‘contemporary eP [ePrescribing] systems serve wider purposes in prescribing, supply, administration and recording functions, as well as audit and review’(249). For the purposes of this review I have chosen to focus on the prescribing and implementation of electronic prescribing systems. However, it has been important to bear these other factors in mind.

Electronic prescribing has been billed as improving safety, quality and efficiency of prescribing through: increased legibility (255); the ability to alter drug prescriptions without having to go back to the ward a patient is on to do so (255); facilitating microbiologists to monitor, guide and evaluate antibiotic usage (254;255)

However, some studies have found that electronic prescribing systems introduce their own set of difficulties and challenges(236). Electronic prescribing systems in use in hospitals vary in complexity and functionality, with some being without clinical decision support tools so that, for example, the capability to prevent doctors prescribing incorrect doses or ability to pick up on potential drug interactions is absent (254;255). Conversely some systems have been criticised for being over sensitive with doctors continually receiving pop-up warnings. This overexposure to warnings means that these often go ignored through alert fatigue. Bignardi et al concluded in 2010 that electronic prescribing will never reach its potential unless it has a fit for purpose clinical decision support tool. They suggest that local healthcare professionals need to be involved in the design and implementation of these systems(254). This correlates with the finding that 25% of studies come from four US centres of excellence who have introduced in-house eHealth systems in a gradual, iterative process with engagement of clinical staff(5). Likewise, although of questionable generalizability to the UK, Abramson et al found, in their small case study of physicians in the US, that transitioning between electronic prescribing systems may pose important safety threats(289). They examined the perspectives of physicians who experienced the transition from a locally developed EHR, with a basic clinical decision support system, to a commercial EHR with a more advanced clinical decision support system. Despite intensive input by the information systems team, the latter was felt to be overly complex and was perceived to reduce efficiency(289).

Abdel-Qatar et al, in their retrospective observational study of pharmacists' interventions in an electronic prescribing system at hospital discharge, found that prescribing errors were common even when using an electronic prescribing system. They concluded that it was

imperative that pharmacists were aware of the limitations and strengths of the electronic prescribing system in use so that they targeted the weaknesses and complemented, as opposed to duplicating, the systems strengths(290).

Although there is limited evidence, there may be differences between the collection rate of electronic prescriptions between different age groups and this needs to be explored further (277)

As I have described, there is a large disparity between electronic prescribing in primary and secondary care within the UK. The *EPS* is geared towards use by general practitioners and for patients with stable, chronic conditions(291). A completely different approach has been taken with the introduction and roll out of electronic prescribing in secondary care(89). Legislation and regulations have developed with these two separate entities in mind. It is therefore a major challenge trying to come to a solution, which we can use in a research context trial situation, which bridges the existing gap between primary and secondary electronic prescribing systems. Changing a statute requires a bill to Parliament, which is unlikely to achieve a favourable outcome within a feasible time frame, to change what can be described as a limiting clause billed at time when things were very different to the current climate. We have reached a solution for the exploratory pilot but this is not feasible for the roll out of a larger trial.

In the following section I describe how I applied review findings to ePrescribing within eSTI2 to develop a robust, regulation-compliant ePrescribing solution:

6. ePRESCRIBING WITHIN THE eSTI² *CHLAMYDIA*

***TRACHOMATIS* CLINICAL CARE PATHWAY**

Within the eSTI² exploratory study we aimed to manage a group of people that had a specific diagnosis, genital *Chlamydia trachomatis*, for which, when uncomplicated, the first line

treatment is a single dose of azithromycin (1g PO). The online clinical consultation was designed to act as a decision making tool to ensure that only the people for whom it was appropriate and safe to prescribe azithromycin, for a known diagnosis of chlamydia, received treatment this way; as such it has similarities to a patient group direction. A patient group direction however, was not deemed suitable for this study as it would involve patients being asking additional questions at the pharmacy and would add no benefit to access testing via existing internet postal testing and pharmacy testing. In practice, the investigator of the eSTI² study was the named doctor on the e-prescription and her GMC number was supplied. In order to minimise the patient identifiable data used, we would have ideally followed the same practice that occurs in some GUM clinics and use a unique patient number and the patient's date of birth as methods of identification on the electronic prescription. This was unlikely to be acceptable to community pharmacists (264;267;292) and so, for the purposes of the exploratory study, users name and date of birth were provided. The address collected from patients was the first four digits of the postcode only.

6.1 MEETING GMC REQUIREMENTS FOR REMOTE PRESCRIBING

When patients accessed their results via the eSTI² results service (see Chapter 5), information was provided to users on chlamydia, why it needed to be treated, and the treatment itself. Links to patient information documents on the diagnosis and treatment were provided for those who required more information. Those who required clarification of this information, who encountered problems completing the online clinical consultation, or who suffered adverse effects from the treatment were advised to ring the clinical helpline number (available 09.00-17.00 Monday to Friday). In the case of symptoms suggestive of anaphylaxis, users were advised to seek immediate medical attention. Patients were assessed for the need to be examined as part of the online clinical consultation. They were provided with a patient information leaflet and standard written information on azithromycin in addition to the

information they were provided with online. We believe that this meets GMC requirements for prescribing and remote prescribing (261). However, the actual implementation of an electronic prescribing system in the NHS, for azithromycin 1g PO stat, from a secondary care based service to a community pharmacy proved more challenging.

6.2 IMPLEMENTING ePRESCRIBING IN THE eSTI² CHLAMYDIA ONLINE CLINICAL CARE PATHWAY

Options for the electronic prescribing component of the online clinical consultation are summarised in Table 49 below. We decided that email authorisation was the only viable option at this stage. In line with the guidance described above, I designed the email to include the patient's name, date of birth, description of the drug to be authorised, name of doctor prescribing the drug and the GMC number of that doctor. In order for us to be able to verify that the medication had been given to the patient, I included a link on the email which the pharmacist was instructed to click when they gave out the medication. This then produced a time-stamped record on our system.

Figure 6 illustrates the information sent in the email authorisation to the pharmacy chosen by the patient.

Table 49: ePrescribing options for the eSTI² chlamydia clinical care pathway

Option	Feasible	Comments
Texting Quick Response code to patient	No	Resolution of currently available mobile phones; <i>The NHS (Pharmaceutical and Local Pharmaceutical Service) Regulations 2013</i>
Electronic prescription service	No	The EPS requires the prescribing system to interact with the National Care Record Service Spine via the national communication infrastructure; involves patient being registered on the Personal demographic service with identifiable data transferred including: name, address, date of birth and NHS number. Goes against <i>NHS Sexually Transmitted Diseases Regulations 2000</i> (139).
Develop new electronic prescribing service	No	<i>The NHS (Pharmaceutical and Local Pharmaceutical Service) Regulations 2013</i>
Email NHS prescription (FP10) to pharmacy	Not at present	<i>The NHS (Pharmaceutical and Local Pharmaceutical Service) Regulations 2013</i> . 'FP10 SS can only be used by hospitals if the hospital prescribing system has been accredited to do so by NHS Business Services Authority'(265). This is currently being explored as a potential solution for a future trial.
Pharmacy download FP10 from webtool	Not at present	<i>The NHS (Pharmaceutical and Local Pharmaceutical Service) Regulations 2013</i> . 'FP10 SS can only be used by hospitals if the hospital prescribing system has been accredited to do so by NHS Business Services Authority'(265). This is currently being explored as potential solution for a future trial.
Private prescription	No	If a drug is available via an NHS prescription for a NHS patient then it is not possible to use a private prescription for that drug (293).
Fax prescription	Yes	Goes against the ethos of what we are trying to achieve
Email authorisation to px ¹ - selected pharmacy and provide pharmacies with pre-packed azithromycin to give out	Yes	Similar to a Patient Specific Direction(294;295), with patients being assessed on an individual basis. Prescribing doctor's name and GMC number present, but with the absence of an electronic signature. Current solution for the exploratory trials, and has worked for the APT ² trial. However, not a feasible solution if the online clinical consultation is rolled out to an RCT/larger trial/incorporated into NHS practice.

¹ patient; ² Accelerated Partner Therapy (296)

Figure 6: Email authorisation

Barts Health

NHS

NHS Trust

e

STI

2

Barts eSexual Health Clinic

You are authorised to give out a pre-packed dose of Azithromycin 1g stat to

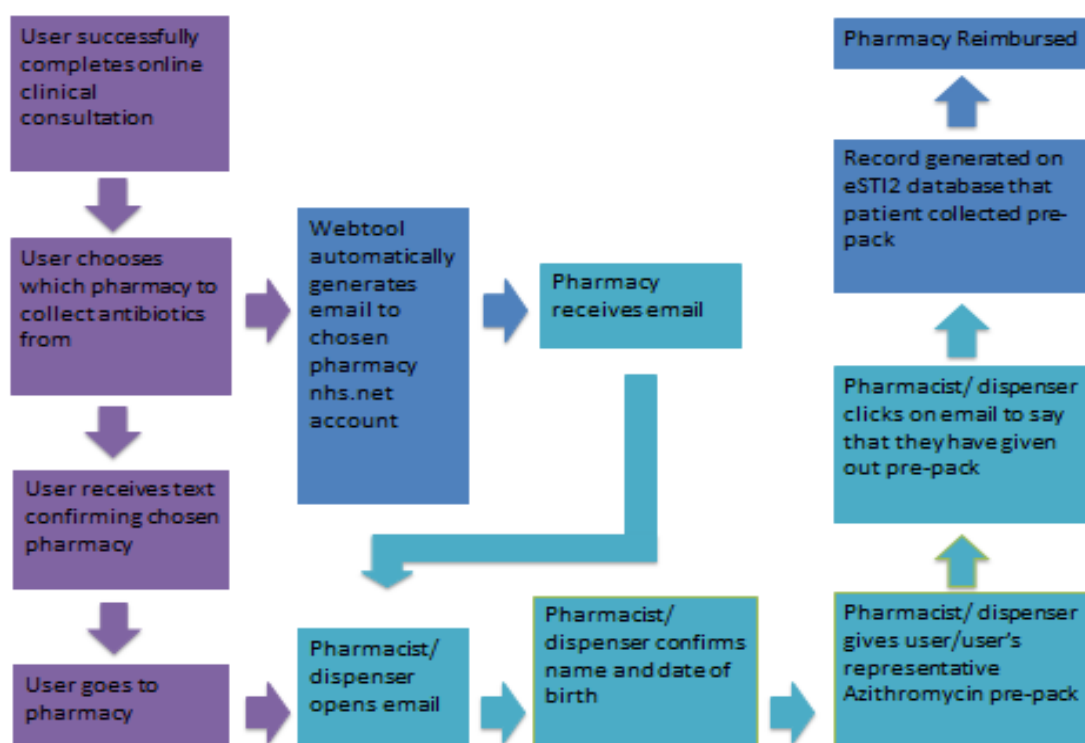
Name & date of birth of patient

Please click to confirm that you have given the above named patient the Azithromycin 1g stat pack:
<https://eSH.bartshealth.nhs.uk/confirmation/resultsnumber123456>

Dr Claudia S Estcourt GMC Number 3469680

The final ePrescribing pathway is shown in Figure 7 below.

Figure 7: Schematic diagram of the eSTI² prescribing pathway



Chapter 4: Methodology for the *development* of a remote online clinical care pathway for the management of genital chlamydia

This chapter is composed of the following sections:

1. Introduction
2. Methods for developing the remote online clinical care pathway
3. Framework to inform the development of future online clinical care pathways

1 INTRODUCTION

As part of my role within the eSTI² consortium, I was required to develop an online clinical consultation which would form part of the online clinical care pathway to manage people diagnosed with genital chlamydia. NHS England and the Department of Health have advocated eHealth and patient centred care (9;84-87;89;90;297). However, despite extensive literature searching, I was unable to identify any validated tools or methods to guide the development of a remote online automated clinical care pathway nor any similar pathways from any branch of medicine. There is no process by which an online care pathway can be quality marked or accredited. In view of the novelty of this type of care pathway, we needed to ensure developmental rigour. Although there is no specific guidance for online pathways there is, however, a substantial amount of information available that can be used to indirectly inform the development of such a pathway. The use and adaptation of existing standards and materials was at the heart of my approach here.

The last twenty years have seen the growing use of proformas (often for face to face care), algorithms, protocols and pathways within the NHS with the aim of improving quality of care, efficiency and patient safety. Advances in technology, developments in organisational structure and increasing multidisciplinary working have encouraged this expansion. Sexual health has been one of the first protagonists of this. With a standard set of questions being required in most sexual health consultations (298), and the multidisciplinary nature and increased role of nurse-delivered care, patient history proformas have been rapidly adopted. These were initially in paper format but are now increasingly in electronic format. Where clinics are based within a hospital, this has been aided by Genitourinary Medicine (GUM) clinic notes being separate from the remainder of the hospital's clinical records(139). This has allowed the implementation of electronic health records (EHRs) to occur without being dependent on the rest of the hospital in terms of timing of implementation, or software used. Uptake of EHRs has been driven by the need for a computerised database containing patient information for vital public health surveillance purposes(95), which are more demanding than required in most other medical specialities, and for audit, with the speciality having well-organised national and regional audit networks(299).

There is widely available professional guidance and comprehensive information available on the care and management of patients in traditional sexual health settings. Notably, this includes British Association for Sexual Health and HIV (BASHH) guidelines and recommendations on how a sexual history consultation should be conducted(298), what it should contain, and how to manage genital *Chlamydia trachomatis*(300).

In this chapter I describe how I used what was relevant and available from existing literature and in traditional clinical practice, to develop the methods to enable the development of an online clinical care pathway for the management of *Chlamydia trachomatis*, and highlight and justify the decisions made.

As outlined in my introduction, although this is a substantive piece of original research, it does not lend itself to any of the commonly used research reporting structures. I have adopted a different write up format which best fits the nature of this study.

1.1 DEFINITIONS

Clinical protocols are defined as "a comprehensive set of rigid criteria outlining the management steps for a single clinical condition or aspects of organisation"(301). In most sexual health clinics clinical protocols are in place for the management of several common conditions including, for example, chlamydia, genital warts, women requiring emergency contraception, people who have being sexually assaulted, and for assessment and care of people requiring post-exposure prophylaxis of HIV.

The **eSexual Health Clinic** is an online sexual health service. It includes all aspects of the patient journey, the clinical helpline, health promotion and all communication between different services (see Figure 36)

Clinical care pathways have been defined as ‘structured, multidisciplinary plans of care designed to support the implementation of clinical guidelines and protocols’(302). Examples of clinical pathways in Sexual Health include the management of women with post-coital bleeding and the management of pregnant women with HIV.

The **Chlamydia Online Clinical Care Pathway**, which I developed, sits within the eSexual Health Clinic and encompasses the multiple pathways that patients can follow from receiving a text allowing them to access their result to the two week health adviser follow-up (for positive patients who consent (see Figure 36).

The **online clinical consultation** is an “automated medical assessment” section of the chlamydia care pathway in which the patient is asked clinical and behavioural questions to determine whether it is safe to proceed to remote treatment, to collect partner notification information, and to conduct a risk assessment and identify other health needs (see Figure 36).

Partner notification is ‘the process of contacting the sexual partners of an individual with a sexually transmitted disease (STD) and advising them they have been exposed to infection’(303).

1.2 eSTI² CONSORTIUM REQUIREMENTS:

As part of the eSTI² consortium, an online clinical management pathway needed to be developed for use in the context of an exploratory study of remote management of genital chlamydia. The pathway aimed to enable people with genital chlamydia to receive their test result online, obtain information about the infection, complete an online clinical consultation, and progress to receive a remote prescription of antibiotic treatment in a safe, efficient manner. As part of this pathway, an online clinical consultation was required as a history-taking and decision making tool to ensure that those people for whom remote care was appropriate were able to access treatment, and those people who were not suitable for this pathway were fast-tracked into clinic.

The eSTI² exploratory studies were conducted to test the safety and feasibility of the online clinical care pathway ((REC: 13/LO/1111; IRAS: 112513) see Appendix III for protocol). Two groups of patients were recruited:

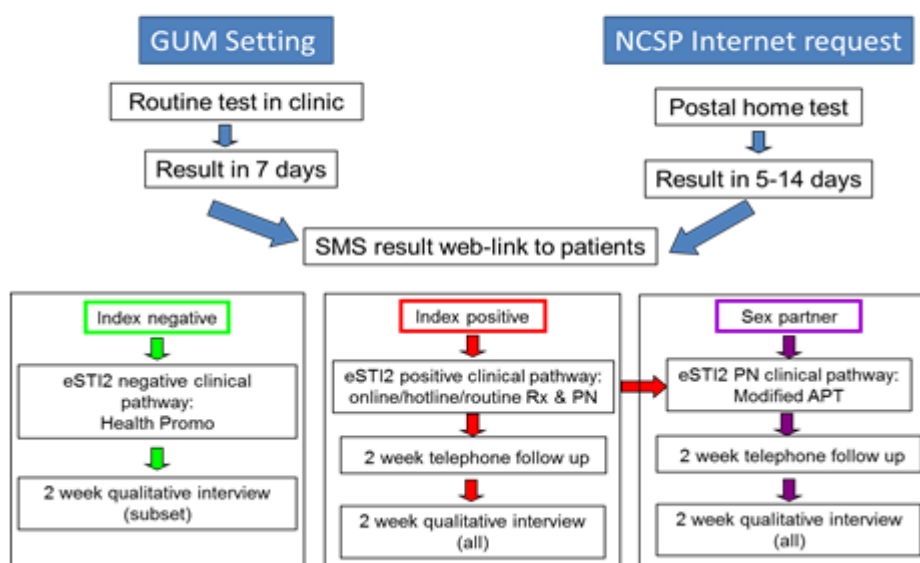
1. Chlamydia negative and positive users in six London boroughs who had accessed online National Chlamydia Screening Programme (NCSP) chlamydia postal self-sampling testing via the Checkurself website and met the inclusion criteria
2. Chlamydia positive patients from Barts Health Sexual Health Centre and St George’s Courtyard Clinic who met the inclusion criteria

The inclusion criteria for patients recruited from GUM (those testing positive for genital chlamydia only) and NCSP sites (those testing positive or negative for genital chlamydia) were:

1. Patients 16 years of age and over; 2. Patients who tested positive for genital *C.trachomatis*
3. Patients who were able to read and understand English. In addition, patients recruited from the NCSP sites needed to have accessed their test via the Checkurself internet-based postal testing website. Exclusion criteria included: 1. Co-infection with another STI; 2. Rectal *C.trachomatis*; 3. Patients who did not provide a mobile telephone number.

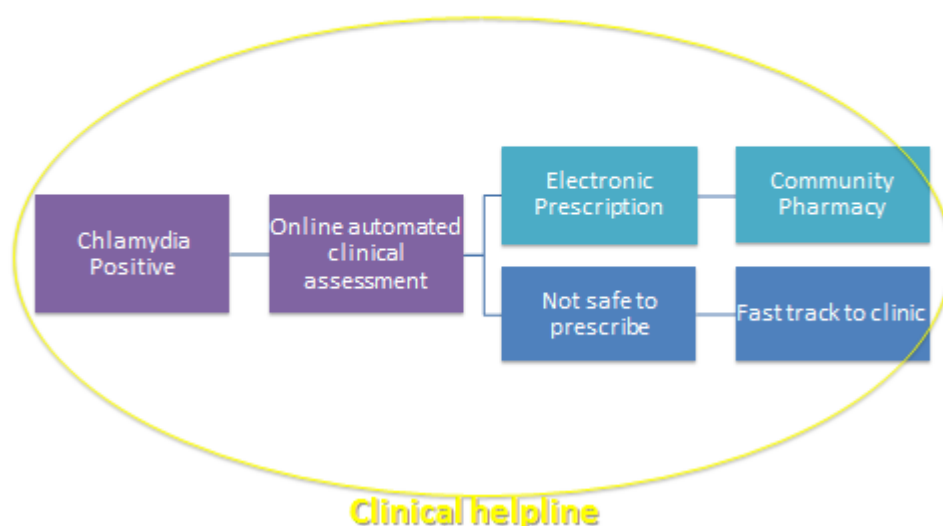
For the duration of the study, patients at each of these sites underwent chlamydia testing in the customary manner and were then able to access their results via the eSTI² results service, which formed part of the Chlamydia Online Clinical Care Pathway (Chlamydia-OCCP) (see Figure 8 below for overview of the exploratory study). For the six NCSP London boroughs, the eSTI2 results service (see page 188) replaced the standard method of receiving results for all users testing negative for genital chlamydia and all eligible patients testing positive for genital chlamydia for the duration of the study. Consent was not required for users testing negative.

Figure 8: eSTI² chlamydia clinical care pathway exploratory study



Those patients who tested positive for genital *Chlamydia trachomatis* were then offered the chance to access treatment online. All patients who consented went through an online clinical consultation, partner notification process and, if appropriate, were able to choose one of 30 participating pharmacies from which to collect their medication, without having any contact with a healthcare professional (see Figure 9 below and Appendix III). As is current practice in traditional services, clinical follow-up occurred at two weeks via a phone call from a Research Health Adviser.

Figure 9: Overall participant pathway within the exploratory study



2 METHODS FOR DEVELOPING THE REMOTE ONLINE

CLINICAL CARE PATHWAY

I conducted a wide literature search to identify “validated” methodology, and examples of similar online care pathways, to inform the Chlamydia-OCCP. I was unable to find an example of methodology that could be used, or adapted, to develop an online clinical care pathway, taking people from diagnoses through to remote management, without contact with a healthcare professional. There are however, examples of where sections of comparable

pathways have been developed and implemented into clinical practice, and guidelines and standards in place which cover traditional care. Therefore I needed to develop new methods to underpin the Chlamydia-OCCP. I organised this literature into four broad categories:

Review of literature concerning online clinical consultations

Review of relevant proformas and protocols in contemporary sexual health use

Review of current national standards in sexual transmitted infections

Review of existing results service and sexual health questionnaires

2.1 REVIEW OF LITERATURE FOR ONLINE CLINICAL CONSULTATION

I used the methods described in Chapter 2 to conduct this literature review. I initially separated the pathway into its individual components (results service, clinical consultation, partner notification, treatment and prescribing). I then conducted a literature search on the development and content of these individual components. This included a search on clinical consultations with a focus on online, remote consultations, and self-completed history taking tools. I then conducted a search of the acceptability and effectiveness of online or remote clinical consultations. I then expanded this search to include results services and partner notification. The review of literature, legislation and regulations surrounding electronic prescribing and the methodology behind the development of the ePrescribing process being used in the exploratory study are described separately in Chapter 2.

Protocol driven search

I conducted an electronic search via NHS Evidence of MEDLINE, EMBASE, and The Cochrane Library using the NHS Evidence database thesaurus terms shown in Table 50.

Appendix II illustrates the search strategy I conducted using the above NHS Evidence database thesaurus terms and free text. I searched official Government, NHS and professional association websites, including existing professional guidance. I then searched Google and Google Scholar to capture both medical and grey literature that had been missed in the above

searches. I used both reference and citation tracking to widen the scope of relevant sources found.

Table 50: NHS Evidence database thesaurus terms for review of literature on online clinical consultation

Ambulatory care facilities	Internet
Attitude to computers	Medical history taking
Cell phone	Methods
Chlamydia trachomatis	Online systems
Communication	Organization and administration
Computer	Patient satisfaction
Contact tracing	Questionnaires
Data collection	Remote consultation
Decision making	Reproducibility of results
Decision support systems	Self-disclosure
Electronic mail	Sexually Transmitted Diseases/diagnosis
Health promotion	Social desirability
Health survey	Standards
Interviews as topic	Telemedicine
Legislation and jurisprudence	Text messaging

I will discuss the findings of this literature and how they informed decisions about each element of the Chlamydia Online Clinical Care Pathway in Chapter 5. However, from this review of the literature, it became apparent that there was going to be several important components that needed to be included in the development process: 1. Expert review group; 2. Cognitive testing. A key component of the development of a clinical care pathway is the presence of a multi-disciplinary group of experts, with expertise in the speciality and in the development of clinical decision systems(304). Although informal discussion with other experts was carried out at all stages of development, I felt it was important to make expert review an integral part of the framework and for this review to take place as soon as the draft

online clinical consultation was in place. This allowed the content and sequence of the consultation to be optimised prior to comprehension testing.

With the absence of a health care professional to explain anything that is not clear or that is misunderstood, comprehension testing is a vital step in the creation of an online clinical care pathway or self-completed survey. For example, extensive cognitive testing was conducted as part of the methodology behind the National Survey of Sexual Attitudes and Lifestyles (NATSAL) (168). As well as ensuring that people's interpretation of the questions were the same as the researchers, cognitive testing was used by the NATSAL team to check the overall flow of the questionnaire and understanding of certain terminology(169).

2.2 REVIEW OF RELEVANT PROFORMAS AND PROTOCOLS IN CONTEMPORARY SEXUAL HEALTH USE

I reviewed and analysed existing self-completion registration forms and basic history-taking proformas in use in several clinics with different approaches to user journeys within London and in a more rural setting. Ambrose King Clinic is in Tower Hamlets, serving a deprived, ethnic minority population. Barts Sexual Health Clinic is an inner city clinic with a commuter population. Both of these clinics reside within Barts Sexual Health Centre. The Courtyard Clinic is in a deprived part of South East London, whilst West Suffolk Hospital is a rural district general hospital. These clinics use a mixture of paper-based and electronic notes. I used these clinics to provide an illustration of proformas and protocols in use. I divided the content of these into sections, and I tabulated the content and questions to enable easy comparison (see Tables 51 and 52 below).

Registration

Table 51 below illustrates the questions asked at registration by the different clinics.

Table 51: Questions asked at registration

Clinic	Hospital	Type of notes	Questions asked at registration							
Barts Sexual Health Centre	St Bartholomew's Hospital, London	Electronic	Contact details	Demographics	Reason for attendance/symptoms	Risk assessment				
Courtyard Clinic	St George's Hospital, London	Paper and electronic	Contact details	Demographics	About you – testing history and basic sexual history	HIV testing history	Risk assessment	Symptoms	Vaccination against Hep B	Feedback on questionnaire
West Suffolk Hospital	Bury St Edmunds, Suffolk	Paper	Contact details	Demographics	Permission to email/text/ phone	Reason for attendance/symptoms				

Clinical consultation

The Courtyard clinic has different proformas depending on the patient's gender and sexual behaviour (for men). The proforma for MSM has an additional section on mental health which includes questions on previous psychiatric history, depression and self-harming. In addition, there are more extensive questions on relationships/consent, blood borne virus risk assessment, chemsex, and consequences of drug or alcohol use. West Suffolk hospital has separate proformas for women and men.

Table 52 below illustrates the sequence of the history taken at each of the individual clinics.

Table 52: Sequence of history taken during consultation

Clinic	Sequence of history taken								
Barts Sexual Health Centre	History of presenting complaint	Sexual History	Past medical history, medications	Smoking, alcohol, drugs	Allergies	Risk assessment	Reproductive history	Contraception	Domestic violence history
Courtyard Clinic	Presenting problem	Allergies and Drug reactions	Sexual History	Past medical history, medications	GU history	Hep B vaccination history	Alcohol, smoking, drugs, vulnerability	Risk Assessment	HIV testing history
West Suffolk Hospital	Presenting complaint and history of presenting complaint	Past medical history, medication and allergies	Reproductive history	Sexual history	Risk assessment	Drug, alcohol and smoking	Immunisation history	Testing history	Family history

2.3 REVIEW OF CURRENT NATIONAL STANDARDS

To ensure that both the pathway and online clinical consultation met a satisfactory standard in terms of content, patient care and safety, and satisfy existing guidance and recommendations, I examined the following national guidelines and guidance:

British Association of Sexual Health and HIV (BASHH)(305)

2006 UK National Guideline for the Management of Genital Tract Infection with *Chlamydia trachomatis*

UK National Guideline for the Management of Pelvic Inflammatory Disease 2011 (updated June 2011)

UK National Guidelines for HIV Testing 2008

Guideline for consultations requiring sexual history taking 2013

UK National guidelines on safer sex advice [2012]

Management of STIs and related conditions in children and young people [2010]

Standards for comprehensive sexual health services for young people under 25 years 2002

BASHH Statement on Partner Notification for Sexually Transmissible Infections [2012]

UK National Guidelines on the Management of Adult and Adolescent Complainants of Sexual Assault 2011

BASHH patient information leaflets: a guide to - Safer Sex

European guidelines(306)

2010 European guideline for the management of Chlamydia trachomatis infections

European guideline for the organization of a consultation for sexually transmitted infections, 2012

General Medical Council(307)

Consent

Good Medical Practice [2013]

Good practice in prescribing and managing medicines and devices [2013]

0–18 years: guidance for all doctors

Protecting children and young people: the responsibilities of all doctors

Medical foundation for HIV and Sexual Health (MEDFASH)

Recommended standards for sexual health services [2005](121)

Standards for the management of sexually transmitted infections [2010] (updated January 2014)(308)

Faculty of sexual and reproductive health(309)

Combined Hormonal Contraception missed pill guidance (2011)

Emergency contraception guidance (2011)

2.4 REVIEW OF EXISTING SERVICES AND STUDIES

Within sexual health the use of both mobile phone technology and the internet has increased (25;310). Despite this, at present in the England there are no online NHS pathways for STIs taking a person from testing to result, with the possibility of diagnosis and remote management, without contact with a health care professional. There are, however, an increasing number of private providers of online STI testing including Dr Thom(192), test.me(311) and Superdrug(161).

Private providers all provide a variety of different testing options, at differing prices, and allow patients to access treatment online. However, they are not constrained by the same rules and regulations as NHS services, although they can be regulated by the Care Quality Commission

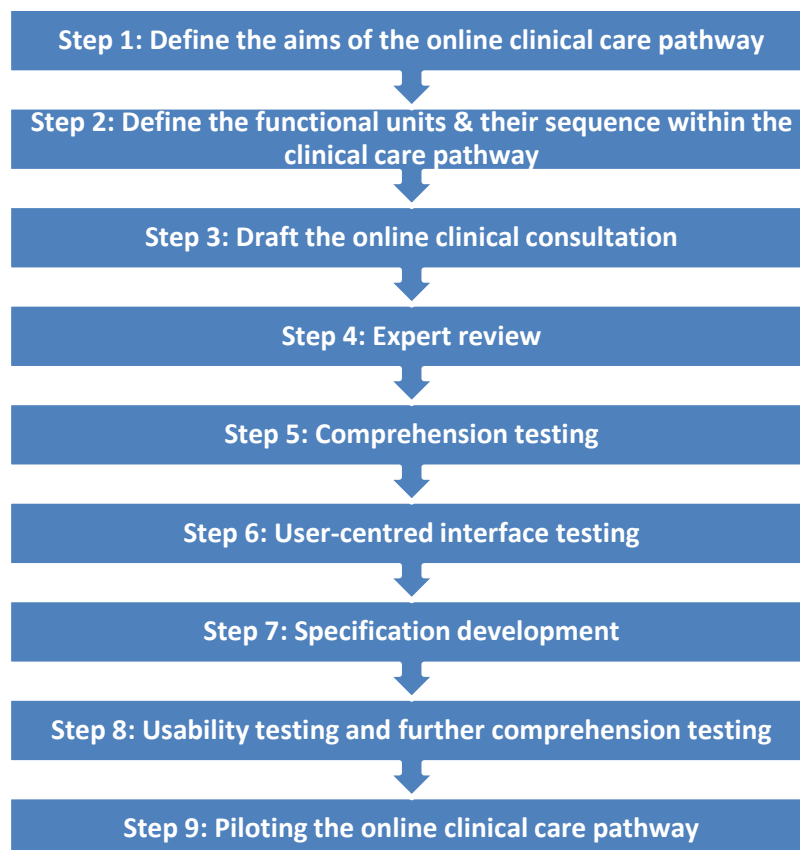
(for example Dr Thom is). There is a certain amount of controversy in terms of tests offered, with test.me offering a '10 STI test' option which includes tests for *Mycoplasma hominis* (non-pathogenic) and *Haemophilus ducreyi* (extremely rare in the UK)(311). In addition no information is provided on the importance of partner notification and, in the case of DrThom(312), all patient-completed health proformas are reviewed by a doctor prior to that doctor emailing the patient a private prescription.

In 2014 Spielberg et al published the findings of their study, conducted in California, exploring the acceptability and feasibility of an online system for the testing, management and integration of care of STIs (188). This paper was published after the methodology described in this chapter had been implemented. The study involved only small numbers of participants and required a clinician to fax a prescription to a pharmacy. However, it has provided a useful comparison to the eSTI² study and is discussed at the end of this chapter.

The information synthesised by applying these four categories to my literature search, combined with my clinical expertise as a specialist GUM doctor, provided me with the knowledge base for the Chlamydia Online Clinical Care Pathway. Having reviewed and analysed this information, I concluded that there was no method I could directly apply and that I needed a method and structure within which to develop the online pathway, which could be flexible and comprehensive enough to meet the needs of a complex clinical care pathway, such as this for management of genital chlamydia, but if possible would be adapted to other STIs/sexual health conditions or the wider medical field. For this reason I designed the eClinical Care Pathway Framework (see Figure 10 below).

3. FRAMEWORK FOR THE DEVELOPMENT OF AN ONLINE CLINICAL CARE PATHWAY

Figure 10: The eClinical Care Pathway Framework (eCCPF)



The Framework has nine steps. Although Figure 10 depicts the eCCPF as a linear process, it is very much an iterative process that is difficult to describe in a linear format. For example, steps four to nine all resulted in amendments to previous steps at different points in time.

The eCCPF was based on a synthesis of different methods used in diverse studies. Steps one to three were a natural outcome of the evidence gathered in section 2, where it became clear that I would need to establish what we trying to achieve, then examine the sequence of how we were going to do it as an online pathway, and then develop the central component, the online clinical consultation. As with the standard set by NHS pathways, every clinical question and every piece of advice given in the online clinical consultation should be evidence-based, with clinical safety being the priority(304).

Steps four to nine were derived from the evidence base described above and in Chapter five.

Although usability testing is relatively late in this framework, at Steps 6 and 8, qualitative research on the acceptability of an online clinical care pathway for the management of genital chlamydia was conducted at an early stage of the project, prior to the development of the framework and Chlamydia Online Clinical Care Pathway (228). If the eCCPF is to be applied to different clinical conditions in the future, and engagement with potential users has not occurred prior to the development, then it would be prudent to either move Step 6 further up the framework or to conduct similar preliminary qualitative work prior to applying the eCCPF.

I applied the framework to develop the Chlamydia Online Clinical Care Pathway which is discussed in Chapter 5.

Chapter 5: Development of the Chlamydia Online Clinical Care Pathway using the eClinical Care Pathway Framework

This chapter is composed of the following components:

1. Introduction
2. Step 1: Aims of the online clinical care pathway
3. Step 2: Defining the functional units and their sequence within the online clinical care pathway
4. Step 3: Draft of the online clinical consultation
5. Step 4: Expert review
6. Step 5: Comprehension testing
7. Step 6: User centred interface design
8. Step 7: Specification development
9. Step 8: Usability testing and further comprehension testing
10. Step 9: Piloting of the online clinical care pathway

INTRODUCTION

In this chapter I will describe how I used the knowledge base and applied the Clinical Care Pathway Framework described in Chapter 4 to develop the Chlamydia Online Clinical Care Pathway.

STEP 1: AIMS OF THE ONLINE CLINICAL CARE PATHWAY

Informed by existing literature and guidance, along with knowledge of the eSTI² clinical pathway and aims of the consortium, I clarified the aims of the Chlamydia-OCCP. These are listed in Figure 11 below.



Figure 11: Aims of the Chlamydia Online Clinical Care Pathway

1. To ensure that the online clinical pathway appropriately predicts the clinical situations for which azithromycin is the appropriate drug to use (i.e. uncomplicated chlamydia)
2. To ensure that all patients are provided with sufficient, comprehensible, information on chlamydia and health promotion
3. To ensure that patients who are more medically or psychologically complex, or require further input, speak to, or are seen by, an appropriate health care professional in a timely manner
4. To ensure that it is safe to prescribe azithromycin for any particular individual patient using the on-line pathway
5. To identify the number of sexual partners for whom partner notification is appropriate
6. To explain partner notification to the index patient, and offer support
7. To provide a process whereby sex partners can access the eSTI² clinical care pathway if desired, or to identify alternative options, for management as a contact of chlamydia.

STEP 2: DEFINING THE FUNCTIONAL UNITS AND THEIR SEQUENCE WITHIN THE ONLINE CLINICAL CARE PATHWAY

I led a small team of experienced clinicians and researchers within the eSTI² consortium to draft the initial clinical care pathway. As currently there is not a point of care test for STIs that can be used at home and interact with other information communication technology, we



decided to concentrate on the pathway from the point of diagnosis, results provision, and management of infection through to health adviser follow-up.

We chose to use chlamydia as it is the commonest bacterial STI in the UK, is tested for in the community through the NCSP, and has a single dose of oral antibiotics as first line treatment (300). The online clinical care pathway has been tested in the exploratory pilot study (see page 110 and Appendix III). The pathway was based on existing practices in specialist GUM services, and was adapted to meet the needs of a remote pathway.

Crucial differences between this remote consultation and other consultation methods in existing use (e.g. traditional face-to-face interviews and computer assisted self-interviews) were highlighted as part of this process. Whichever point a person chooses to access care, a certain amount of information needs to be collected in terms of identifying factors and demographics. However, in the case of a completely remote pathway where someone accesses a self-sampling test via, for example, the internet or uses a self-test at home, the amount of information that needs to be taken has not been quantified. I have therefore chosen to design a common pathway which goes beyond this, so that it does not matter where somewhere originally accessed their test, we still collect the information that is required for clinical, surveillance, and reimbursement purposes. Figure 12 shows the traditional clinical care pathway sequence whereby a patient comes in to clinic, a history is taken, examination performed, investigations conducted, results given and patient managed. Some studies have shown that the addition of clinical examination to the management of asymptomatic patients is likely to yield only minimal additional diagnoses or changes in management (142;313), and the current national advice is that, apart from where someone has been sexually assaulted, examination is not required in asymptomatic patients (298).



Figure 12: Sequence of elements of care within a traditional clinical care pathway

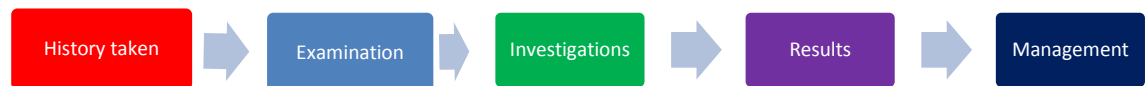


Figure 13 illustrates the online clinical care pathway. Patients recruited from the NCSP (see page 168 and Appendix III), having accessed postal testing via the internet, will not have had any contact with health care professionals. Therefore we will have a diagnosis for these patients without knowing their medical, drug and sexual histories. Even those patients recruited from clinic, if they have gone through asymptomatic screening, will have had only minimal history recorded. The sequence of elements of care which I identified as being optimal for managing a patient with a diagnosis but with no or very little history known, was investigation, results, taking a focussed history and then deciding the appropriate management.



Figure 13: Sequence of elements of care within an eclinical care pathway



This is a radical departure from the sequence of traditional care and has major implications in terms of the content, phrasing, logic and order of the questions asked in the history taking section and the information that needs to be provided at each stage.

Figures 14 and 15 below illustrate the patient user journeys which I developed for the eSTI² chlamydia clinical care pathway trial.

Figure 14: NCSP User Journey

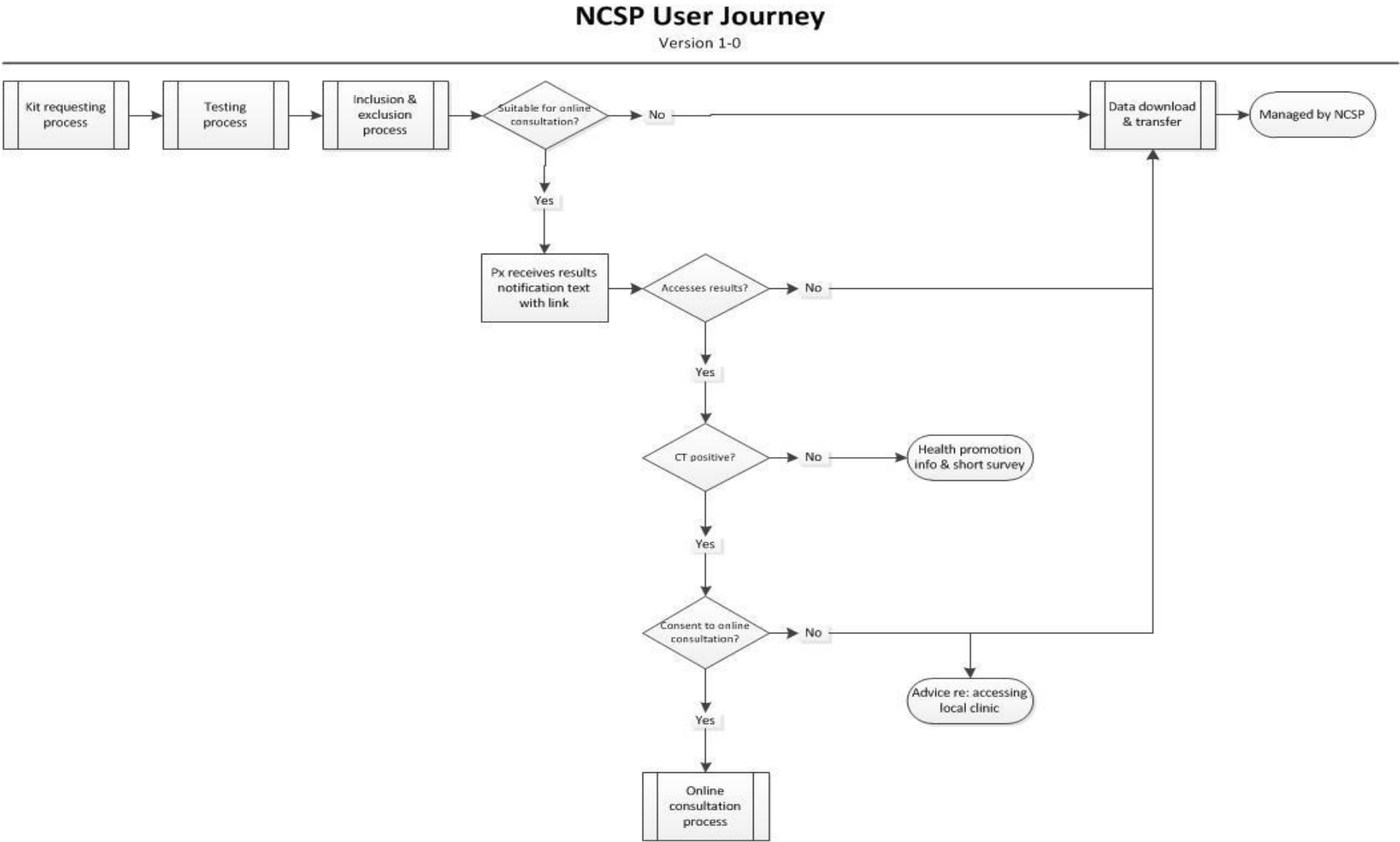
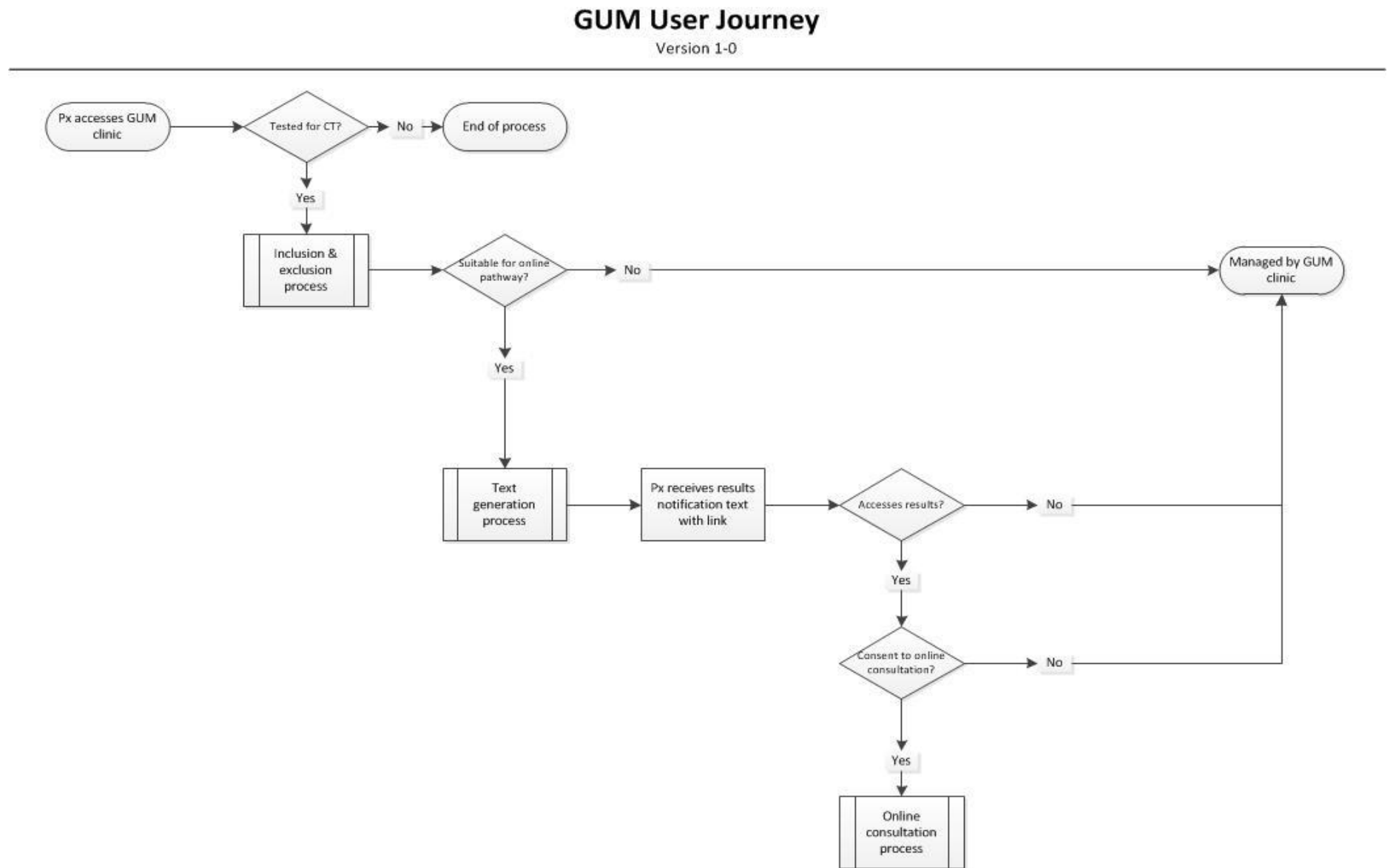


Figure 15: GUM User Journey





STEP 3: DRAFT OF THE ONLINE CLINICAL CONSULTATION

I will now discuss the development of the results service and online clinical consultation.

RESULTS SERVICE

Objective:

To develop an efficient and acceptable method for patients to access their results that takes in to account the need for confidentiality, privacy and the ability to continue on the online clinical care pathway if appropriate.

Evidence from the literature:

The method whereby GUM patients are informed of the results of their investigations has changed over the past 10-15 years. We have progressed from the situation where the majority of clinics worked on a 'no news is good news' policy, where the service only contacts people who have tested positive for an infection, to the routine use of short messaging service (SMS). The latter was initially implemented with a designated health care professional (HCP) texting individual patient's, using a mobile phone. This then developed to the use of web-based SMS systems, which enable HCPs to contact multiple patients simultaneously with a template email message, or lab-linked systems whereby as soon as the laboratory gets the result of the test/s a message is automatically sent to the patient. As well as potentially increasing patient satisfaction, reducing the burden of phone calls being handled by members of the GUM clinic team, and increasing efficiency, both increasing patients' receipt of results and subsequent treatment rates have been cited as reasons for implementing alternative eHealth results services(314).



Combining my clinical experience and the literature, I have identified the following methods of notifying people of the results of their investigations which have been used in Sexual Health services in the UK: 1. 'No news is good news': the service only contacts people who have tested positive for an infection; 2. Face-to-face (patient returns to clinic to get result); 3. Telephone (either patient is given an appointment to ring for their results or a HCP rings them on an ad hoc basis); 4. Telephonetics (whereby a patient rings up an automated service at a pre-determined time (e.g. one week) and accesses their results by inputting a unique number and date of birth); 5. SMS; 6. Email; 7. Online Results Service.

No news is good news

Brown et al conducted a quantitative questionnaire-based survey of 202 Genitourinary Medicine patients and 542 community based patients to evaluate their preference for obtaining test results amongst other outcomes. They offered the following options for receiving results: 'no news is good news'; face-to face; by telephone; SMS/text; email; internet. The most unpopular option was the 'no news is good news' option, which has been commonly in use until recent times(315). Likewise Llewelyn et al found that this option was deemed highly unsatisfactory by participants in their qualitative study of patients' choices for attending sexual health clinics (316).

Face-to-face

Brown et al found that 41% (n=304) of the people that responded to their survey preferred to receive their STI test results face-to-face(315). Likewise, in a study of patients preferences for receiving STI or HIV test results conducted in Sydney Sexual Health Centre, Martin et al found that 40% of patients preferred to receive their results in person if they had a positive



STI result(317). Labacher and Mitchell, in their paper-based survey of students in South Africa and Canada, found that 78% ($n=90/116$) of the South African students and 57% of Canadian students ($n=105/183$) preferred to receive their STI results face-to-face respectively (318). However, the current conflict between patients' wishes and service delivery within an austere financially-guided, target-driven environment means that providing every person who tests for STIs with their results face-to-face is not a realistic or feasible option(182).

Telephone

Forty percent ($n= 295$) of participants in Brown et al's questionnaire survey chose telephone as their preferred method of receiving test results(315). A lower proportion of patients at the Sydney Sexual Health Centre chose this as their preferred option, with approximately 13% indicating that this would be their first choice(317). In the survey of South African and Canadian students, mobile phone as the preferred option for receiving STI results was more popular with Canadian students (36% ($n=66/183$)) compared to South African students (9% ($n=10/116$)). Providing all results via telephone is not a viable option for Sexual Health Services in the UK.

Telephonetics

Patients at a small number of services including Barts Sexual Health Centre receive their STI results via a telephonic service. This involves the patient, one week after having been tested, ringing up a designated phone number, and providing their unique results number (given at first attendance) and date of birth to access the results. Despite there being evidence that this an effective, efficient method of providing results(319;320), I did not consider this to be a viable option for the Chlamydia-OCCP as it would be difficult to then link the patient in to online care.



Short Message Service (SMS)

Lim et al describe the benefits of SMS in their review of SMS usage in sexual health(310): as the name suggests, it is mobile and therefore not dependent on landlines or fixed equipment; messages are received by patient almost instantaneously; the patient can choose when they want to read the message; low cost; convenient for provider; messages can be sent either from a mobile phone, computer or web application; it is possible to send a message to multiple recipients simultaneously; ubiquity of mobile phones; popularity as a method of communication.

However, there is currently a lack of a strong evidence base for the acceptability of texting people with their results directly displayed on the SMS (e.g. with 'your chlamydia test is positive'). Brown et al found that less than 5% of people preferred to receive their results by SMS(315). 2% (3/183) of Canadians and 9% (10/116) of South Africans preferred to receive this results this way (318), whilst approximately 33% of clients' at Sydney Sexual Health Centre would be happy to receive negative results via SMS and approximately 14% would be happy to receive positive results this way(317).

Contacting those people who test negative for STIs via text message is an acceptable option for providers and, although perhaps not the preferred method of contact, is a feasible option for informing patients of their results (310;315). The ambiguity lies with those who test positive. Lim et al showed that use of mobile phone technology reduced the time to treatment for chlamydia(182).



However, Fuller et al highlighted that privacy is a major concern for young people when testing for STIs, with the fear that one of their friends or a parent may pick up their phone and read the text message (228). In addition, despite concerns about confidentiality and embarrassment, when given a positive diagnosis people wish to be able to discuss this with an 'expert' in order to gain the reassurance they need in terms of what the diagnosis means and how it can be managed (315). It also provides an opportunity to discuss how to inform sexual partners, and how to prevent the same thing happening again. Sending someone a text informing them of a positive diagnosis, or using a telephonetics system to provide results, could only achieve these other elements of care if linked to clinic resources but it clearly goes nowhere near to replacing a face-to-face or telephone service.

A review conducted by the NCSP failed to find any literature on the phrasing of test results text messages(321). They conducted an internal review, finding that there was great variation in the wording of text messages between different chlamydia screening offices. As part of a Health Protection Agency web-based survey of young people conducted in 2012, three questions were included to help establish acceptability of the phrasing of results messages. Amongst other findings, they found that 7% of young people misinterpreted the statement 'your test result is positive' and 25% misinterpreted 'your test result is negative'. From this, the NCSP recommended several different options for the wording of chlamydia test result text messages.

Email

In previously conducted surveys, email has been an unpopular method of contact for provision of test results (315;317;318). The reason for this was not explored by the authors, although



Brown et al suggest that it might be due to the inability to interact directly on a real time basis with a healthcare professional (315).

Online results services

Although, in surveys of peoples' preferences, only a small proportion would opt to get their results via a secure internet site (315;317), there are several examples where online results services have been introduced into clinical practice.

An online STI results service was implemented in San Francisco in 2004 in an attempt to relieve the pressure on staffing of an existing results phone line and to improve patient satisfaction. Initial patient acceptability was suboptimal with only 40% of patients opting to create a password to use the service(322).

In 2007, an online STD clinic was launched online in Amsterdam for syphilis and HIV testing. Patients were able to download a referral letter that they could use to access testing at a laboratory free of charge. Their results were then made available online. This service was mainly targeting men who have sex with men (MSM) and, proving a popular option with this population, it was expanded to including testing for other STIs(323).

The first paper evaluating an online test results system in a predominantly heterosexual population was published in 2010 by Ling et al. Denver Metro Health STI Clinic introduced a web-based results system in June 2008. They conducted an evaluation comparing the proportion of test results accessed, and how these results were accessed over three different time periods: (A) in the six months prior to implementation of the online service; (B) during the six month period where patients had to create their own passcode to access their results; (C) the four month period after passcodes were automatically generated and assigned to patients. Findings included a 41% (1616/3931) uptake of the online results service in period (B), with a statistically significant ($p<0.0001$) higher proportion of patients actually receiving their results



during this period (74%, 1198/1616) compared to those who opted for phone results (62%, 1431/2315). There was no significant difference between the proportions of patients actually receiving their results during the three time periods. However there was a significant ($p<0.0001$) decrease in the proportion of patients phoning the clinic between the three different time periods, from 67% (2446/3624) in period (A), to 51% (1985/3931) in period (B), to 36% (537/1501) in period (C). The primary reason for people choosing to access their results online was the ability to access their results any time of the day. Reasons for people still opting to access their results by phone included preferring this option and limited internet access(314).

Decisions for eSTI² results service

Method

Various points needed to be considered in choosing the method to be used for the Chlamydia-OCPP. These included how a user gained access to their results (such as using a username and password), and the information that needed to be conveyed. The aim of the eSexual Health clinic is for appropriate patients to be managed remotely without needing direct contact, either by phone or face-to-face with a healthcare professional. In order to facilitate patients' access to the online clinical consultation it was important to choose the most feasible method of receiving results that could then lead directly on to this.

Synthesising these findings, I concluded that SMS was the modality of choice in terms of initially contacting patients with regards to their results. However, in the interest of privacy the text message needed to be nondescript but credible. In the qualitative work conducted by Fuller et al (228), the NHS as a brand held confidence and trust, therefore we decided that the text

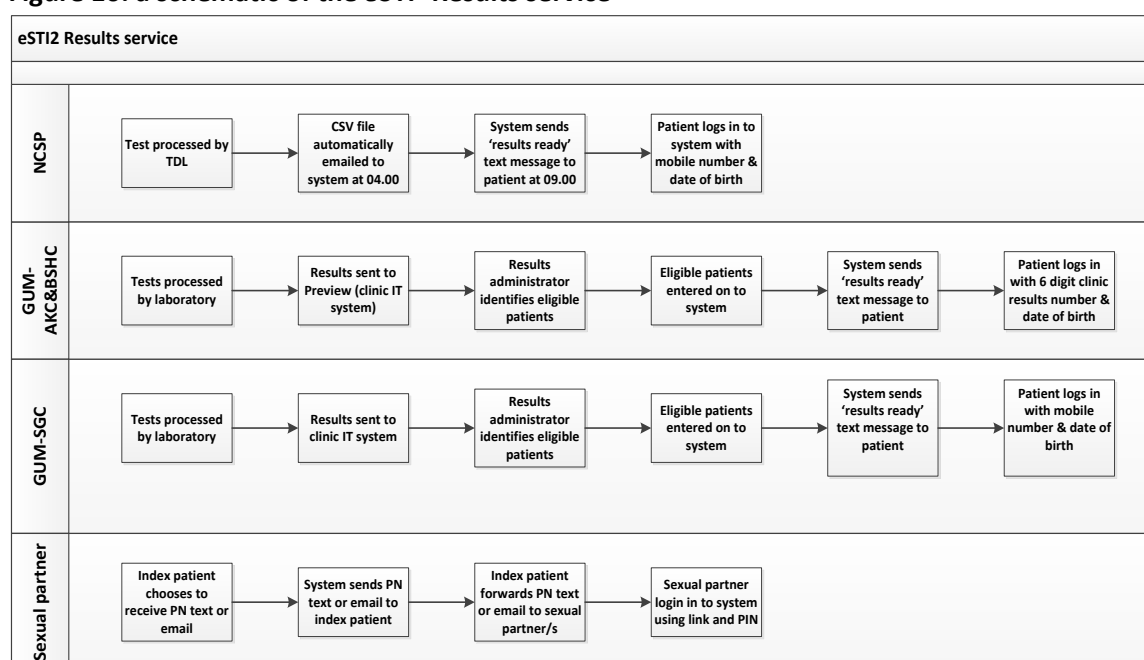


message needed to be sent via the NHS SMS and webmail system, NHS.net, which entitles texts with 'NHS no reply'.

As patients in the exploratory study would be coming from different GUM clinics and NCSP sites, it was important to understand the pre-existing results management processes within each service before considering each possible option in terms of its feasibility and relevance.

Figure 16 shows details of how I operationalised the results service within each setting.

Figure 16: a schematic of the eSTI² Results service



TDL – The Doctors Laboratory; CSV file – comma separated values file; IT – information technology; PARTNER NOTIFICATION – partner notification

As can be seen in Figure 16, I, with input from a senior researcher, had to develop a process whereby the results from the relevant laboratory were loaded on to our system and patients received a text message informing them that the results were ready. This was a relatively simple process for the GUM patients, with a results administrator at each clinic identifying eligible patients and then manually entering them on to the system via the results



administrator portal (see Figure 17 below). As someone was entering details manually, there was a risk of transcription error. This was minimised by: 1. the research health adviser having the ability to change the date of birth if a patient contacted them as they were unable to login; 2. The correct number of digits needed to be entered for both mobile number and results number; 3. A valid UK mobile number had to be entered. This didn't remove all potential for errors to be made but all patients who had not accessed their results within seven days were fed back to the clinic they tested at so they could be contacted by the clinic. If an error had been made it would be picked up at this point.

For NCSP patients, we initially arranged for the NCSP to continue to provide the results texts to these patients. However, they were only able to do this in real time which meant that patients would receive their text message as soon as the result became available, i.e. it could be at any time of the day or night. In addition, all the results for the preceding 24 hours were sent to Epigenesys (the software company who developed and hosted the website) at 04.00 which meant that patients would have their results before their details had been entered onto the system. Instead, we arranged for the results to be sent out by Epigenesys at 10.00 every morning. The rationale behind a 10.00 timing was that the clinical helpline was open from 10.00-18.00. During the first month of the study, I monitored the times at which patients accessed the system and the health adviser monitored the times at which patients called the helpline. From this data, we recommended that the helpline hours be changed to 09.00-17.00.

Those patients accessing Barts Sexual Health Centre are routinely provided with a results number (a unique 6 digit code) to access their results via a telephonetics service. The same login was used for these patients in the exploratory study, along with their date of birth. Those patients accessing their results from the NCSP and St George's used their mobile phone number and date of birth to login.



We chose not to include an option whereby a participant could inform their GP of their result for the following reasons:

1. This a proof of concept trial and interacting with established GP EHR was outside our remit
2. This is not standard practice in GU clinics where anonymity remains an important factor for people accessing this service
3. Although this practice is being increasingly encourage for patients who are HIV positive, and therefore have been diagnosed with a chronic illness and are likely to be on medications that will interact with other medications that the GP will prescribe, this is not the case with other STIs.
4. One of the main points in offering online care is to be able to offer access to testing and treatment which removes interaction with a healthcare professional, and thereby increase accessibility to testing, streamline care, and reduce wastage

I will discuss the online partner notification option offered to index patients on page 238, however I will discuss the method by which sexual partners could access the online clinical consultation here as it follows the discussion of the different pathways by which a patient can access their results depending on which service they initially accessed.

Sexual partners of index patients, who had been passed on a personal identification number (PIN) by the index partner, initially accessed the online clinical consultation using this PIN.

Once they entered the online clinical consultation, they were asked to provide their mobile number and date of birth, and thereafter used these details to enter the online clinical consultation. In order to provide a separate identification for each sexual partner of an index patient, as soon as a sexual partner logged on they were assigned a unique code which is the index patients system identifier along with the number sexual partner they are to use that PIN. For example, if index patient AKC123456 had two sexual partners who chose to use the PIN

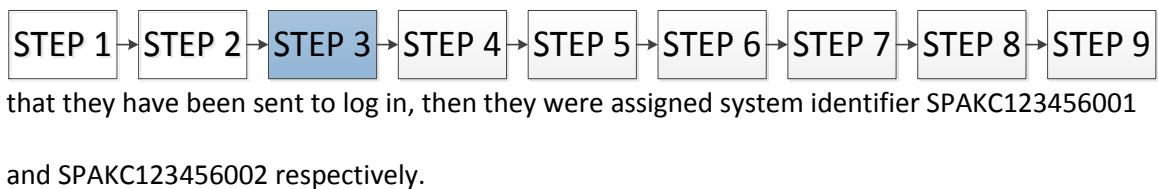


Figure 17: Results administrator portal

eSexualHeath - Add a new patient - Mozilla Firefox

Jo Gibbs - Outlook

eSexualHeath - Add a new ...

https://esti.demol.epigenesys.org.uk/manage/results_administrator/patients/new

eSexualHeath

J Gibbs Log out

ADD A NEW PATIENT

Result

☒ Positive ☐ Negative

Date of birth *

DD MM YY

Date of test

DD MM YY

Results number

AKC

Select the appropriate prefix and type in the 6 (7 for SGC) digit results number

Mobile number *

No spaces, beginning 07

Gender *

☐ Male ☐ Female

Save Cancel

Built by epiGenesys

Message

In line with the NCSP findings and recommendations, I decided that the text message for both positive and negative results should not include the word chlamydia or STI. It was then necessary to design the message so that it was credible and recipients would know that it related to their tests (see Table 53below). This was tested as part of the comprehension testing described in Step 5.



Table 53: summary of the text messages sent to index patients

Clinic/NCSP	Text message
Ambrose King Centre/Barts Sexual Health Centre	Your test results are ready. Your results number is xxxxxx. Access your results online here: https://eSH.bartshealth.nhs.uk/patient_login
Courtyard Clinic	Your Courtyard Clinic test results are ready. Access your results online here: https://eSH.bartshealth.nhs.uk/SGC_login
NCSP	Your Checkurself test results are ready. Access your results online here: https://eSH.bartshealth.nhs.uk/NCSP_login

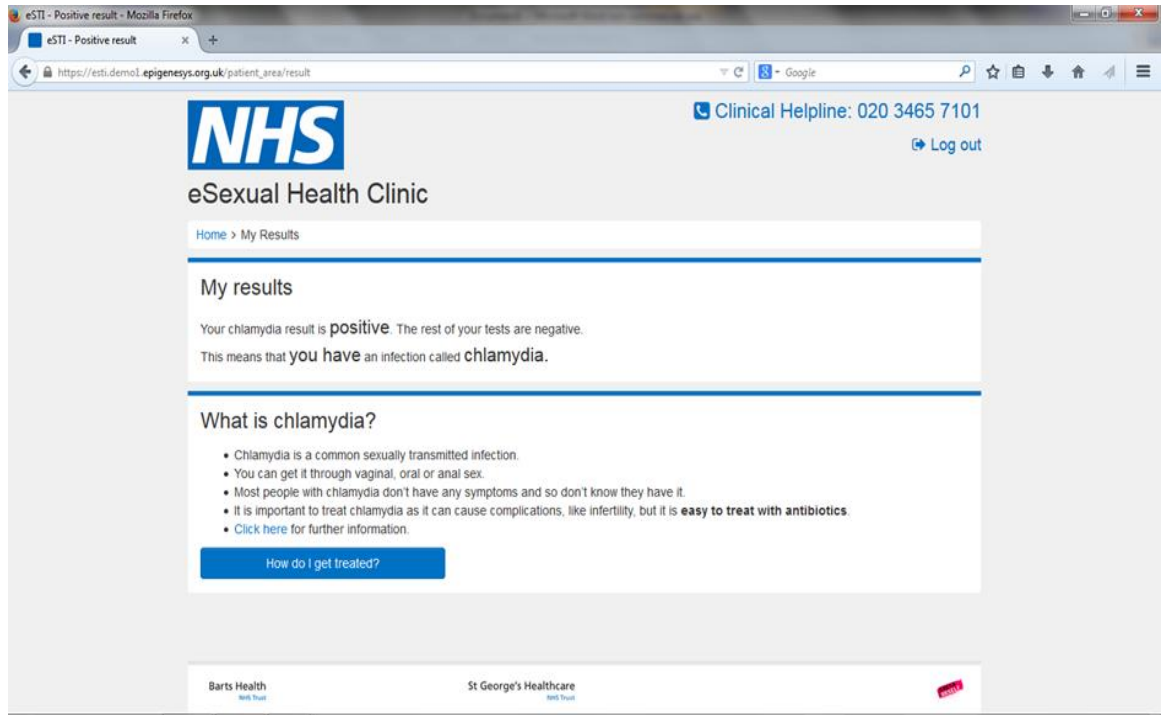
Results page

Based on my clinical experience and Duncan et al's findings in their qualitative study of women who had been diagnosed with genital chlamydia(324), I believed that it was important that patients accessing a positive result received the same information that they would be given in clinic, i.e. a basic explanation of what chlamydia is, how they might have acquired the infection and how it can be managed. This was cognitively tested (see Step 5). For patients requiring further information, I provided a link to the Family Planning Association (FPA) chlamydia leaflet.

Figure 18 below shows the Chlamydia-OCCP results page. 'Click here' links to the Family Planning Association (FPA) chlamydia leaflet.



Figure 18: Results page



ONLINE CLINICAL CONSULTATION

I then developed an initial version of the online clinical consultation drawing on my own clinical experience together with the knowledge base described in Chapter 4. As well as the Chlamydia-OCCP having a different structure to a traditional care pathway, different factors needed to be taken into account with the structure of the online clinical consultation compared to a tradition clinical consultation. An example of the standard structure of a traditional clinical consultation is shown in Figure 19 below (298).



Figure 19: traditional clinical consultation



The order in which the history is actually elicited for the latter five components varies depending on clinic, individual HCP and individual patient. However, the first three components are constant and at some point all of the remaining components would be covered.

When developing the structure of the online clinical consultation, I considered the following aspects:

- Need to establish personal details
- Where people were likely to ‘fall off’ the pathway and need to be fast tracked into clinic. I decided that it was better if people fell off at the beginning of the pathway so that they did not get frustrated by being unable to access treatment even though they had completed the majority of the consultation
- Acceptability of, and comfort with answering, the questions. In a traditional clinic consultation, I would not start by asking someone their sexual history. I would first establish a rapport with the patient. The same can be applied online; although it isn’t possible to establish a rapport *per se*, it is possible to start with questions people are

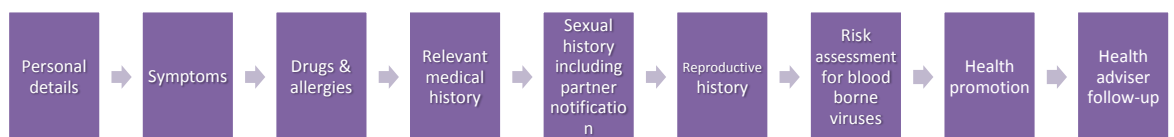


more likely to be comfortable answering (i.e. less intrusive), and to give a brief explanation as to why we are asking these questions.

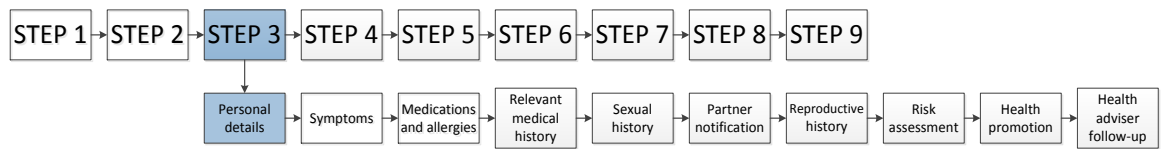
- Issue of confidentiality and privacy in terms of both the online clinical consultation and any SMS or email sent to the patient
- Flow of questions

The structure of the online clinical consultation that I chose to adopt is illustrated in Figure 20 below:

Figure 20: components of online clinical consultation



I will now discuss the development of each of the components in Figure 20 in turn.



Personal details

Objective

To gather the minimum amount of information to enable us to contact the patient, issue an electronic authorisation for antibiotics, and have information on basic demographics to inform both this study, a future full scale trial and for surveillance purposes.

Evidence

The grey literature is mainly concerned with minimising use of personal information, which I have attempted to do. There is a wealth of legislation and regulations relating to data protection, the storage and retrieval of data and patient's rights in terms of access to their data. Some of this is generally applicable whilst some are specific to healthcare and sexual health. Table 54 below summarises this.

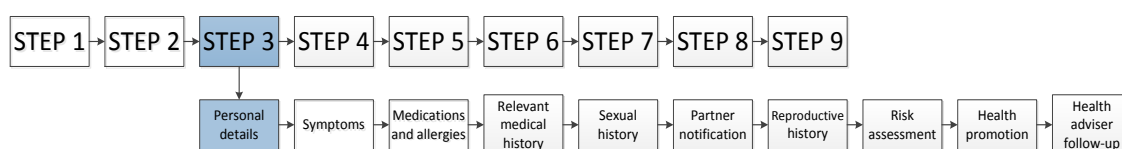
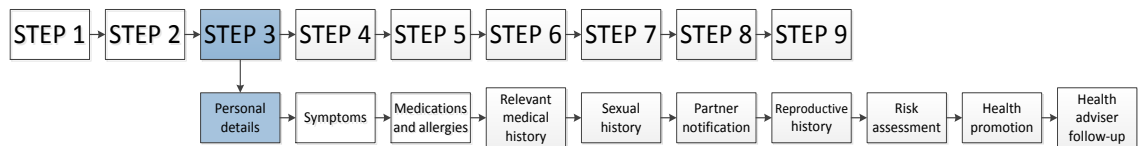


Table 54: Legislation and regulation relating to data protection

Type	Legislation
General	<p>Common Law Duty of Confidentiality</p> <p>Copyright Designs and Patents Act 1988</p> <p>Children's Act 1989</p> <p>Copyright Regulations 1992</p> <p>Crime and Disorder Act 1998</p> <p>Data protection Act 1998</p> <p>Human Rights Act 1998</p> <p>Computer Misuse Act 1990</p> <p>Data protection (Processing of sensitive data) order 2000</p> <p>Electronic Communications Act 2000</p> <p>Freedom of Information Act 2000</p> <p>The Privacy and Electric communications (EC Directive) Regulations 2003</p> <p>Information Security Management: NHS Code of Practice 2007</p> <p>2008 Cabinet Office Data Handling Review Report</p>
Healthcare	<p>Access to Medical Reports Act 1998</p> <p>Access to Health Records Act 1990</p> <p>Health and Social Care Act 2011</p> <p>Public Interest Disclosure Act 1998</p>
Sexual Health	<p>NHS Sexually transmitted diseases regulations 2000</p>

The majority of these have been written before electronic health records (EHRs) were introduced or in common use in healthcare. The Information Governance toolkit⁽³²⁵⁾ is a useful adjunct to help apply, check and ensure compliance with this myriad of legislation and regulations surrounding data storage, management and transfer.



Professional Guidance

Published guidance from the NHS, GMC and other professional bodies includes:

Caldicott Report and Caldicott Principles 1997

Information Security Management – Part 1: Code of practice for information security management (BS7799-1:1999)

Ensuring Security and Confidentiality in NHS Organisations, protecting the security of information in NHS organisations, NHS Executive’s Security and Data Protection Programme

For the Record, HSC 1999/012

Confidentiality: NHS Code of Practice 2003

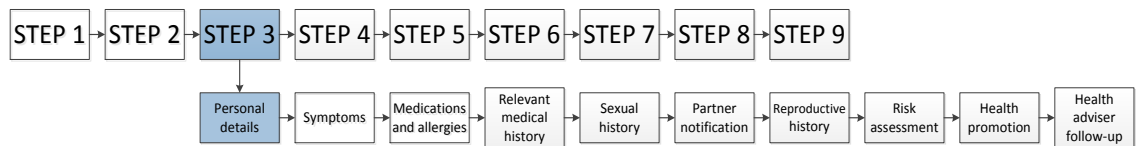
GMC Confidentiality: protecting and providing information

Department of Health: The Caldicott Guardian Manual 2010

Information Commissioner: Data Protection Audit Manual 2001

The number and size of each of these makes reading, digesting and utilising them a laborious and lengthy process. This is compounded by the fact that they are frequently duplicative.

However, having reviewed the available literature, and from my personal clinical experience, I concluded that several factors were important to include. These included: 1. Ensuring that we had two methods of contacting each patient as mobile phones can get lost, stolen or replaced(326;327); 2. Ensuring patients register with their name and contact details before testing if we conduct a future trial with patients self-testing using a POC test at home and then accessing the online clinical consultation. Bracebridge et al, in their evaluation of an NCSP postal screening service in Essex, found that 488 people who undertook testing were not



registered and were therefore unable to be contacted. Of these 4.5% ($n=22$) tested positive for chlamydia (328).

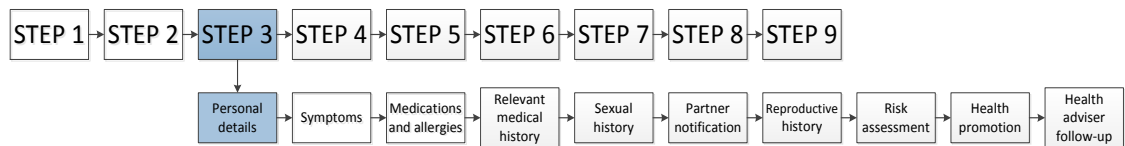
Decision

Surveillance data for Public Health England (PHE) for the chlamydia clinical care pathway exploratory trials was collected from the initial testing site (i.e. Barts Sexual Health Services, The Courtyard Clinic at St George’s Hospital and the NCSP). However, in a future trial it is likely that we will need to collect and communicate surveillance data directly to PHE. In developing the online clinical consultation, as well as referring to the Public Health England guidance on surveillance data, I have liaised with members of the Public Health England surveillance team in order to capture all of the data items required. In England, there are two different sets of data collected for chlamydia diagnoses:

1. Chlamydia Testing Activity Database (CTAD) (329)– collected from primary care and community services
2. Genitourinary medicine clinic activity dataset (GUMCAD)(95) – collected from GUM clinics

The data collected via the system we have designed can be used to provide the relevant data for both of these datasets.

The data collected has been balanced against the need for collecting a minimal amount of identifiable information for security and confidentiality reasons. As is the case in traditional sexual health clinics, patients do not need to give their real name or date of birth. In order to



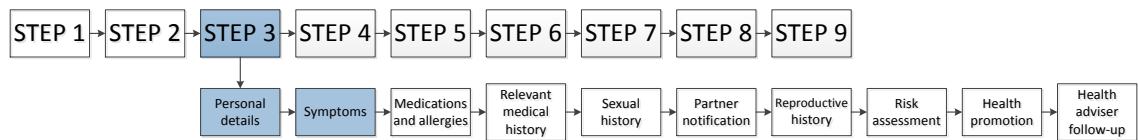
try and prevent underage use, as well as asking for patients' date of birth we also ask for their age. If someone states that they are under 16 then they are advised to contact the clinical helpline to be fast tracked into clinic. We require patients' postcode for reimbursement purposes. As a full postcode is potentially identifiable, when one takes other potentially identifiable data into account, we only request the first four digits of the postcode.

Figure 21 is a screenshot of the 'My details' page of the online clinical consultation.

Figure 21: My details section of the online clinical consultation

I chose to use email as the second contact detail for the following reasons:

1. It is possible to set up an NHS.net account so that outgoing emails will be secure and so that the emails contain the word "NHS" (so it is not mistaken for junk mail).



2. Home phone numbers are not necessarily personal to that individual and could lead to awkward questions for the patient. In addition, the research Health Adviser would be working office hours when the patient is less likely to be at home to receive the call.
3. As with a home phone number, the patient is likely to be sharing accommodation, potentially with parents or partner, which could lead to awkward questions if we were to contact them via post. In addition, I was trying to minimise the identifiable patient collected data for security and confidentiality reasons. Finally, written correspondence can easily fall into 'the wrong hands', would delay any communication needed, and would be reliant on the patient making contact with the health adviser.

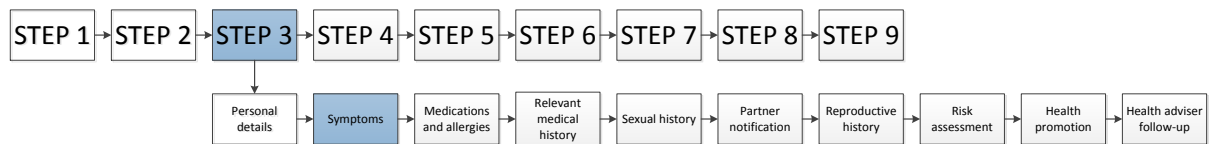
Symptoms

Objective

To ensure that patients who report symptoms suggestive of complicated chlamydial infection, and who may require examination and an antibiotic other than azithromycin, are directed off the pathway and into traditional services in a safe and efficient manner.

Evidence

When taking a history of presenting complaints from a patient, it is standard practice, to check that they do not have a number of symptoms that could indicate infection and/or need for examination even if a patient does not spontaneously report symptoms. In the case of the Chlamydia-OCCP, we already have an established microbiological diagnosis and therefore the rationale behind the questions we need to ask is different. Issues with using any form of protocol include the balance between being safe and being overly restrictive, and being comprehensive without being overly protracted. This is particularly important when the



protocol is being used as an automated decision-making tool without HCP input. I therefore analysed each of the symptoms asked in a traditional clinical consultation and assessed whether, if someone reported the presence of that symptom, it would indicate that they:

1. need to be examined before being treated and/or
 2. need an alternative medication to azithromycin (i.e. complicated infection)
- or
3. need to be examined in the near future but are safe to continue on the online clinical consultation

Decision

Having ascertained which symptoms we needed to ask patients about, I then decided which of them, if disclosed, would mean that a patient would fall off the pathway and need to be fast-tracked into clinic, and which symptoms it would be acceptable for patients to continue on the pathway with but that would need to be discussed at the two week health adviser follow-up. This is summarised in Table 54 below.

In order to ensure that patients who are symptomatic but are able to continue online are flagged up by this system, followed-up and, if necessary seen, appropriately, I ensured that the answers to these questions fed in to the health advisers' follow-up screens and triggered additional questions.

As I wanted to keep the number of questions asked to a minimum and to only ask patient a questions relevant to the individual, at this stage I decided that the female and male online clinical consultations needed to be developed as separate entities, and I employed a skip pattern of questioning.

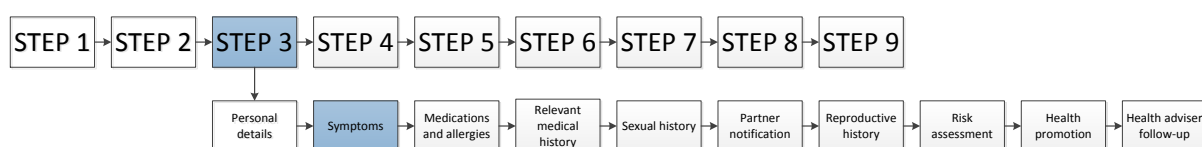
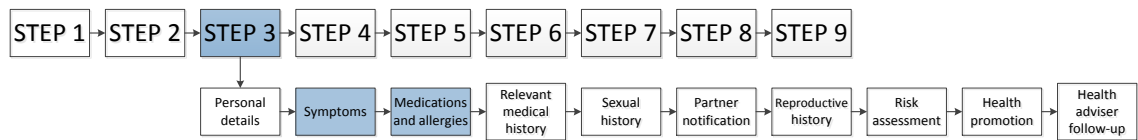


Table 55: Symptom inclusion decision-making summary

Symptom	Assessment	Need to ask in consultation	Safe to continue
Dysuria	Would not change treatment	No	N/A
Discharge	Would not change treatment (as majority of patients tested for chlamydia and gonorrhoea and gonorrhoea is rare in community settings)	No	N/A
Abdominal pain	Patient needs to be examined	Yes	No
Post-coital bleeding	Patient needs to be examined	Yes	No
Dyspareunia	Patient needs to be examined	Yes	No
Testicular pain	Patient needs to be examined	Yes	No
Anal pain	Patient needs to be examined	Yes	No
Genital skin lumps	Patient needs to be examined	Yes	Yes
Genital rash, sores or blisters	Patient needs to be examined	Yes	Yes



The female symptoms screen is shown in Figure 22 below.

Figure 22: Female symptom screenshot

NHS
eSexual Health Clinic

Clinical Helpline: 020 3465 7101
Log out

My Health

Have you had any of the following in the last month or since you last had sex? (Tick all that apply)

- ☐ Unusual lower abdominal pain
- ☐ Bleeding between your periods
- ☐ Bleeding after sex
- ☐ Deep pain with sex
- ☐ Rash, sores or blisters in the genital area
- ☐ Skin lumps in the genital area
- ☐ None of the above

Next

Barts Health

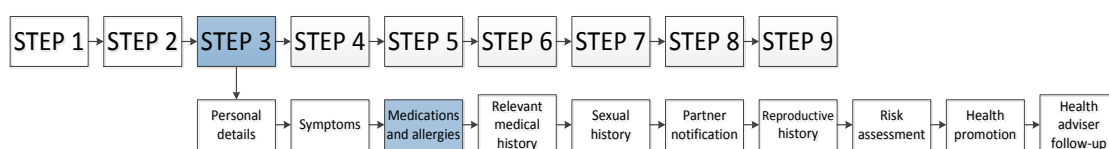
Medications and allergies

Objective

To ensure that any patients for whom it is not suitable to be treated with azithromycin, because of known allergies or concurrent medication, are directed off the pathway into traditional care in a safe and efficient manner

Evidence

I examined current national and regional Patient Group Directives for the prescription of azithromycin 1g stat PO for people diagnosed with Chlamydia to inform the development of the electronic prescribing assessment component of the online clinical consultation. Of note,



the NCSP Patient Group Direction for azithromycin for *Chlamydia trachomatis* has not been updated since November 2012(330).

I aligned this material with the information gathered from the azithromycin Summary of Products Characteristics(331) and the British National Formulary (BNF) (260). Tables 56 and 57 below summarises the list of drugs that interact with azithromycin and conditions where azithromycin is contraindicated or caution advised.

Table 56: Azithromycin drug interactions

Drug	Interaction	Reference	Addressed in online clinical consultation (OCC)
Antacids	Reduces absorption of Azithromycin (advise to take at least 1 hour before or 2 hours after the antacids)	BNF(260)	No – Will be provided on label of azithromycin packet
Artemether with Lumefantrine	Avoidance of macrolides advised by manufacturer	BNF	Yes
Bromocriptine	Macrolides possibly increase plasma concentration of bromocriptine	BNF	Yes
Cabergoline	Macrolides possibly increase plasma concentration of cabergobline	BNF	
Ciclosporin	Macrolides possibly inhibit metabolism of ciclosporin – levels require monitoring	BNF/AzSPC(331)	Yes
Colchicine	Possible increased risk of colchicine toxicity	BNF	Not in SPC and patient unlikely to be on it

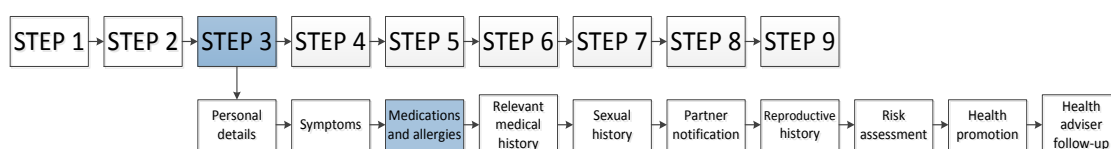


Table 56 continued

Drug	Interaction	Reference	Addressed in online clinical consultation (OCC)
Coumarins	Possible enhancement of anticoagulant effect of coumarins (causal relationship not established)	BNF /AzSPC	Yes
Digoxin	Macrolides increase plasma concentration of digoxin	BNF	Yes
Disopyramide	Possible increase plasma concentration of disopyramide	BNF	Yes – advice re cardiac arrhythmias
Droperidol	Avoidance of macrolides advised by manufacturers of droperidol (risk of ventricular arrhythmias)	BNF	Yes
Ergotamine	Increased risk of ergotism when macrolides given with ergotamine	BNF/AzSPC	Yes
Mizolastine	Macrolides possibly inhibit metabolism of mizolastine. Mizolastine has weak potential to prolong the QT interval in a few individuals.	BNF/MzSPC(332)	Yes
Piperaquine with Arteminol	Avoidance of macrolides advised by manufacturer (possible risk of ventricular arrhythmia)	BNF	Yes
Reboxetine	Avoidance of macrolides advised by manufacturer	BNF	Yes
Rifabutin	Increased risk of side effects including neutropenia (but a causal relationship to azithromycin has not been established)	BNF/AzSPC	No - I don't think we need to ask about this
Ritonavir	Possible increase in plasma concentration of azithromycin	BNF	No - I don't think we need to ask about this

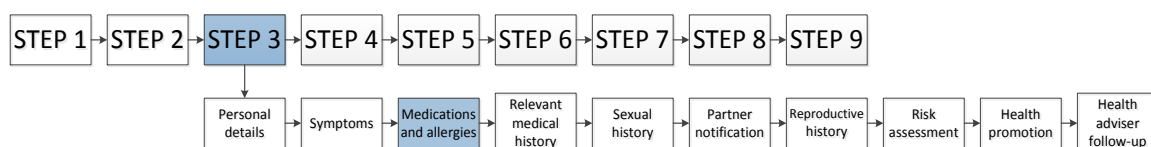
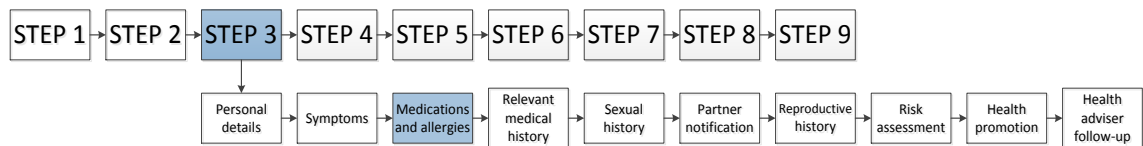


Table 57: Other cautions

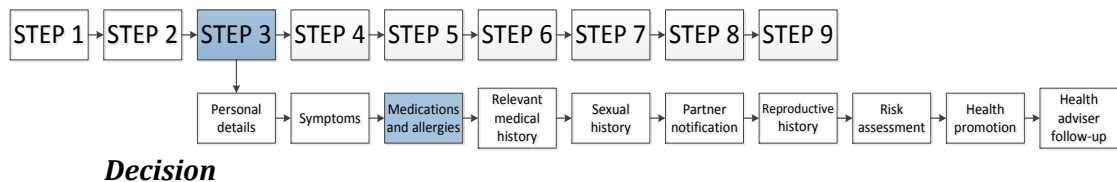
Condition or drug	Reference	Addressed in online clinical consultation
Avoid in severe liver disease	BNF and AzSPC	Yes
Avoid if GFR <10	BNF and AzSPC	
Avoid if known or risk of prolonged cardiac repolarisation and QT interval (incl: <ul style="list-style-type: none"> • Class 1A antiarrhythmics • Class III antiarrhythmics (dofetilide, amiodarone, sotalol) • Terfenadine (no evidence for latter) • Antipsychotics e.g. pimozide • Antidepressants e.g. citalopram • Fluoroquinolones e.g. moxifloxacin and levofloxacin 	AzSPC AzSPC AzSPC AzSPC AzSPC AzSPC	Come off pathway if tick they are on Cisapride or tick that they have been told by a doctor that they have a cardiac arrhythmia. If tick they on citalopram, pimozide or ciprofloxacin they come off the pathway. Moxifloxacin and levofloxacin rarely used in the community.
With electrolyte disturbance (e.g. hypokalaemia or hypomagnesaemia)	AzSPC	No
With clinically relevant bradycardia, cardiac arrhythmias or severe cardiac insufficiency	AzSPC	Yes – see above
Myasthenia gravis	BNF and AzSPC	Yes

Azithromycin was believed to have fewer drug interactions than other macrolide antibiotics due to its inability to interact with the cytochrome P450 IIIA enzyme system(333). Prolongation of the QT interval, with the potential risk of torsades de pointes, was thought to



be only of minimal risk with the use of azithromycin until recent years(334). Following a review of available evidence in 2011, the Food and Drug Administration (FDA) altered information provided on azithromycin product labels relating to risks of QT interval prolongation (335). In 2012, Ray et al published a large cohort study evaluating the use of 5 days of azithromycin in Tennessee Medicaid patients. They found a small increase in absolute risk of cardiovascular event, with those patients at pre-existing highest risk of cardiovascular disease most likely to be affected (336). In 2013 Svanstrom et al concluded that there was no evidence of ‘an increased risk of death from cardiovascular causes in a general population of young and middle-aged adults’ in their national retrospective cohort study(337). From this information base it is possible to conclude that the population that we are expecting to use the online clinical consultation are at very low risk of prolongation of the QT interval. However, account needs to be taken of other drugs that patient may be taking that prolong the QT interval, even if the population risk remains low, as the potential severity of an adverse outcome to an individual is high.

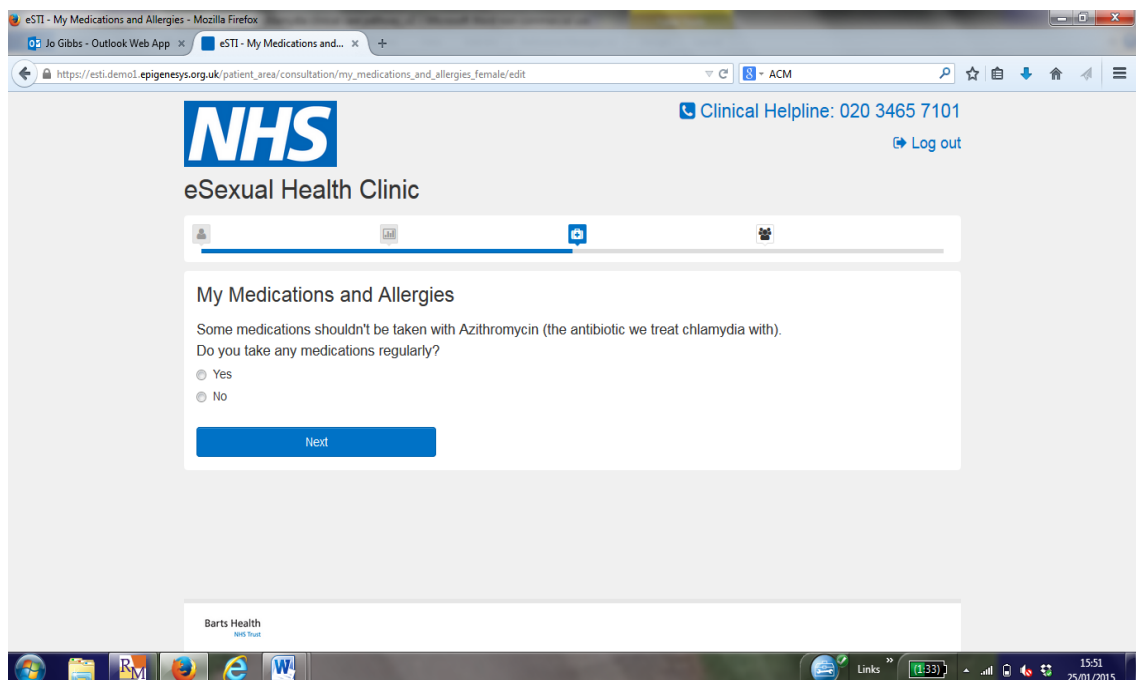
Having reviewed the evidence, I then examined the optimal way to ask these questions so that patients who were not taking any medications and did not have any drug allergies could pass quickly through the section, but those patients who were on medications which were contraindicated with azithromycin or who were allergic to azithromycin, soya or peanuts, or had a medical condition that contraindicated the use of azithromycin, were taken off the pathway.



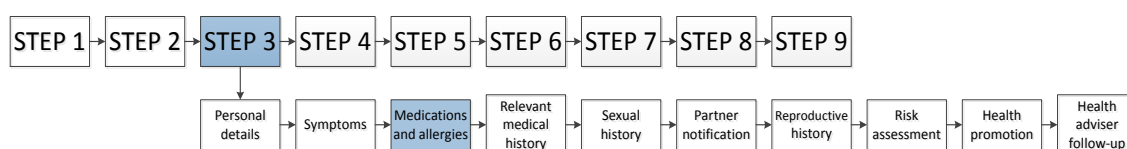
It was clear early on that the traditional sequence and content of the drug history would not be feasible both in terms of the functioning of the automated clinical decision system and in terms of the number of questions required. I approached this by asking the patients as few questions as possible for a safe outcome with respect to prescribing.

Rather than asking patients to list all the medications they are on, I decided it would be safer to ask patients whether they were taking any of a list of medications that are contraindicated with azithromycin. I felt that this removed the need for patients to recall, without prompting, which medications they were on and how to spell them. Figure 23 below shows the wording of this question.

Figure 23: Screenshot of My Medications and Allergies screen



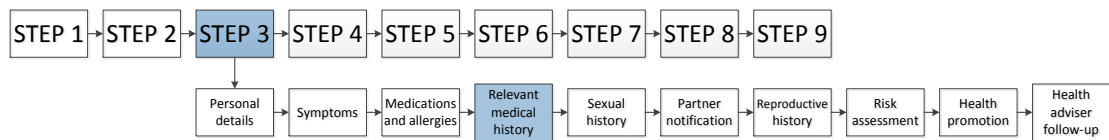
One of the main findings from the comprehension testing (described in Step 5 below) was that members of the public do not know what azithromycin is or they get it confused with



erythromycin. As a proportion of people who take erythromycin suffer gastrointestinal side-effects (338), which they may mistakenly believe means they are allergic to the medication, I felt it was first necessary to ask a set of questions about this to avoid patients being inappropriately precluded. This is described in Table 58 below along with the decision as to whether it is safe for the patient to continue or not.

Table 58: Allergy decision-making section

Question	Safe to continue
1. Are you allergic to any medications? Yes/No	If ticks No
2. <i>If yes to 1:</i> Are you allergic to azithromycin? Yes/No/Don't know	If ticks No
3. <i>If yes to 2:</i> Azithromycin is an antibiotic which belongs to the same family as Erythromycin and Clarithromycin. Have you taken any of these before and had: (tick all that apply)	
a. Itchy rash, throat or facial swelling, or difficulty breathing	No
b. Nausea (feeling sick), vomiting (being sick), diarrhoea	Yes
c. Other reaction	No
d. No	Yes



Relevant medical history

Objective

To ensure that any patients for whom it is not suitable to be treated with azithromycin because of existing medical conditions are directed off the pathway into traditional care in a safe and efficient manner

Evidence

The rationale behind the decision of which questions to ask in this section of the online clinical consultation is described in the Medication & allergies section above. In summary, azithromycin is contraindicated if a person has severe liver disease, severe renal impairment, has a history of, or is at risk of, cardiac arrhythmia, or has myasthenia gravis.

Decision

Although it is important to ask these questions as the risk of harm is potentially high, the majority of patients are likely to be young and healthy. To limit the amount of time this section would take users to complete, I combined the medical conditions into two questions, shown in Figures 24 and 25 below.

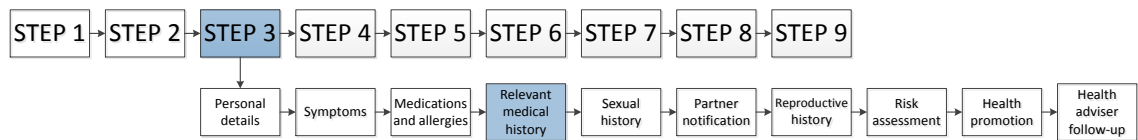


Figure 24: Screenshot of the cardiac-related questions

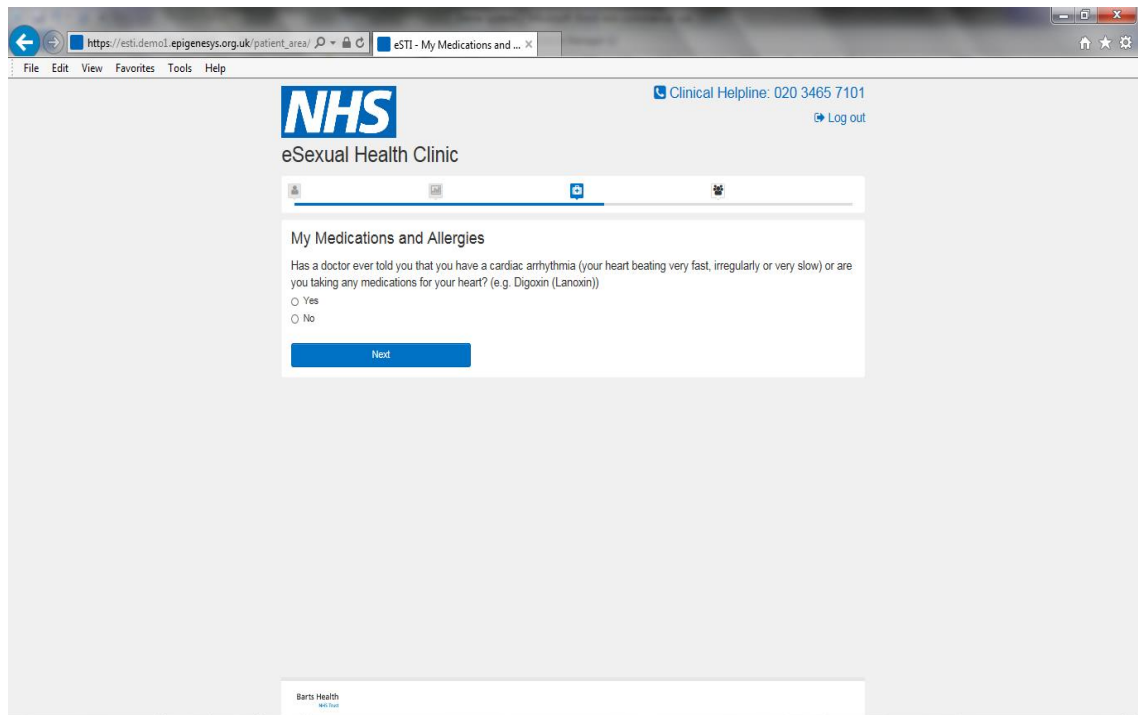
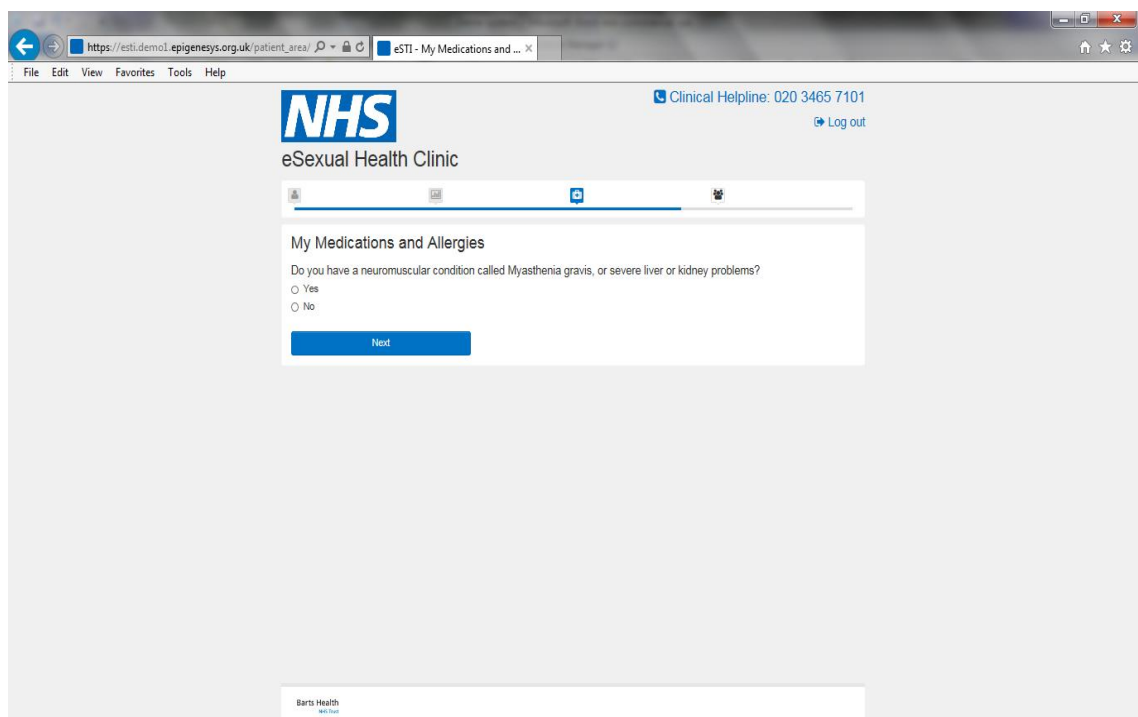
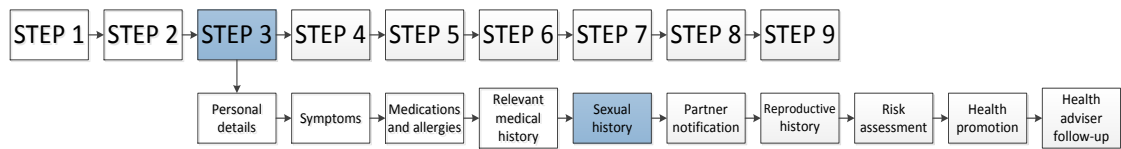


Figure 25: Screenshot of other medical conditions screen





Sexual history

Objective

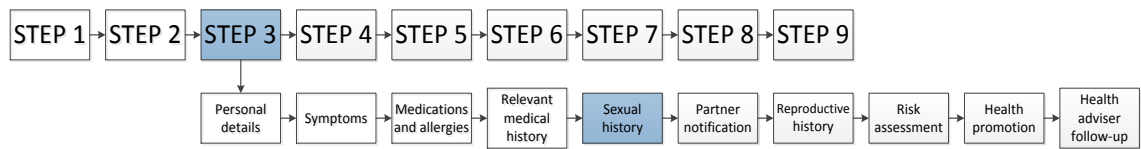
To assess sexual behaviour, identify patients who are at higher risk of other infections or getting recurrent infections in the future and to identify sexual partners who need contacting and treating.

Evidence

I reviewed the literature on recording sexual history in a variety of contexts: face to face; paper questionnaire; self or clinician completed computer assisted questionnaire; sexual behaviour surveys. I appraised complete self-completion questionnaires from the third National Survey of Sexual Attitudes and Lifestyles study(339) and an Australian sexual health centre's Computer Assisted Structured Interview (CASI). The latter was used, with kind permission from Prof Kit Fairley, as Melbourne Sexual Health Centre is at the forefront of research in to Sexual Health and the health service in Australia is similar to that in the UK. I then reviewed national and international guidance and proformas in use in contemporary sexual health services.

Three themes emerged from my review of this literature:

1. Content
2. Bias associated with asking these types of question
3. Validity (discussed in chapter 6)



Content

There are no validated sexual history questions that are designed to be used in an online clinical consultation. I therefore drew on my own clinical experience, proformas in use within sexual health clinics, national(298) and international(340) guidelines, existing validated sexual behavioural questionnaires that have been designed for either online use(190) or computer assisted self-interviews(339), and a computer assisted self-interview in use in a sexual health clinic. These questions went through expert review and comprehension testing as described on page 264 and 265 respectively.

Bias

There are various type of bias that are associated with asking questions in both a sexual history taking context and non-sexual history taking context. Some of these are found irrespective of the method used to take the history, whilst others are more of an issue with certain methods. I have collated and summarised the issues in Table 59 below.

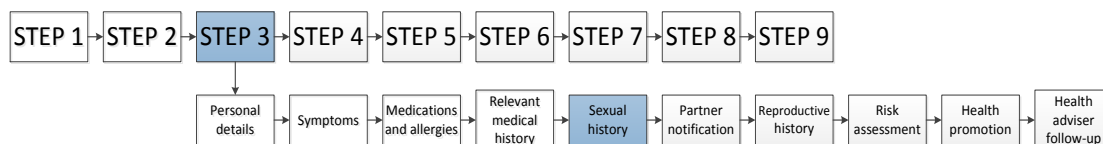


Table 59: Summary of types of bias associated with sexual history taking

Type of bias ¹	Summary of issues	Actions taken to reduce bias in this research
Design bias	With an online clinical consultation there is a risk that users may answer questions incorrectly because of lack of understanding or misinterpretation of what is being asked. There is also the risk that the consultation may not be asking the right questions for an individual patient because of lack of ability to adapt to the individual patient or because the individual scenario had not been considered in the design.	Patient inputted data will be compared with data collected by clinicians in clinic both for GUM patients who consent and for patients who drop off the pathway and are directed into clinic. It is acknowledged that more complex lines of questioning may be 'more suited to face-to-face [FTF] interviews than computer-assisted self-interviews(152)'. Patient inputted data will be compared with data collected by clinicians in clinic both for GUM patients who consent and for patients who drop off the pathway and are directed into clinic (see Chapter 6).
Evaluation bias	By placing people in the situation of being questioned, they become anxious and this may influence their ability to answer.	By being able to enter the information where they want and when they want, evaluation bias could potentially be less of an issue than the situation of a face-to-face interview. How in a FTF interview or on the phone, a HCP may sense that a patient is anxious and seek to assuage this anxiety. This is not possible with an automated online system. Patient inputted data will be compared with data collected by clinicians in clinic both for GUM patients who consent and for patients who drop off the pathway and are directed into clinic (see Chapter 6).
Interviewer bias	As long as the questions asked in an online clinical consultation are not leading, interviewer bias is likely to be reduced in this situation compared to a face-to-face interview	Patient inputted data will be compared with data collected by clinicians in clinic both for GUM patients who consent and for patients who drop off the pathway and are directed into clinic (see Chapter 6). Questions specifically designed so they do not lead patients.
Mood bias	This is likely to be an issue irrespective of whether an interview is conducted face-to-face or using a computer/mobile phone interface remotely.	

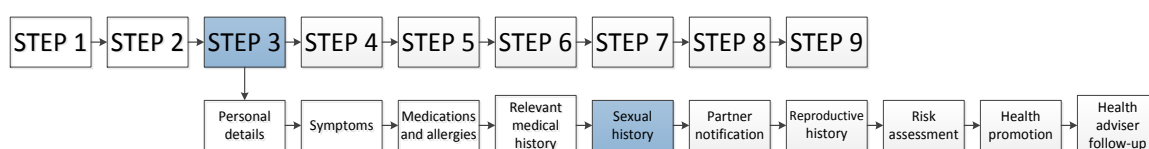


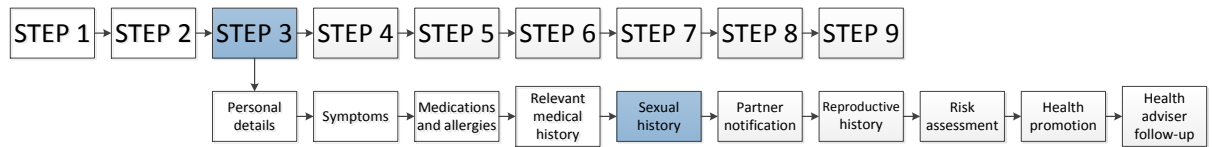
Table 59 continued

Type of bias ¹	Summary of issues	Actions taken to reduce bias in this research
Observer bias	This is likely to be less of an issue with an online clinical consultation than a face-to-face interview	
Recall bias	An issue with both face-to-face interviews and online clinical consultation. Theoretically an online clinical consultation may give people more time to think about their answer without feeling under pressure. Furthermore, Aicken et al found that the majority of participants completing cognitive interviews on a CASI were able to accurately report information about their sexual partners(169).	Patient inputted data will be compared with data collected by clinicians in clinic both for GUM patients who consent and for patients who drop off the pathway and are directed into clinic (see chapter 4).
Reporting bias	It is possible that people will not reveal certain information irrespective of method used to interview them. However, in several studies respondents admitted to a high proportion of risky behaviour when questioned via a self-completion questionnaire compared to a face-to-face interview with a clinician (40;151;156;157;341).	Patient inputted data will be compared with data collected by clinicians in clinic both for GUM patients who consent and for patients who drop off the pathway and are directed into clinic (see chapter 4).
Response style bias	It is possible that participants using the online clinical consultation will respond to a question in a 'yes-saying' manner.	I have tried to phrase the questions, and have arranged the format of the questions to deter people from 'yes-saying' whilst balancing this with making the consultation easy to use.
Social desirability	The greater disclosure of sensitive information seen when computer assisted self-interviews are used has been postulated as being secondary to a reduction in social desirability bias when using this history-taking method.(151-153;155). However, Richens et al, with the findings of their randomised controlled trial, dispute this, arguing that it is the structure framework and mandatory answering of sensitive questions which leads to greater disclosure of information (40).	

¹Adapted from (342) p172-175

Decision

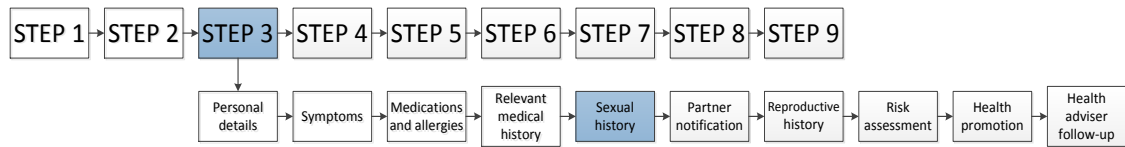
In many traditional clinics, when a patient initially presents a history is taken of a patient's sexual behaviour over the past three months or of their last sexual partner if it longer than three months since they last had sexual intercourse. As we already have a diagnosis with the



patients who are been asked these questions as part of the online clinical consultation, and the majority of these patients are asymptomatic, I chose to use a six month sexual history instead so that this data could inform partner notification. The information gathered also needed to identify higher risk sexual behaviour, so that the health advisers can provide appropriate advice, and to provide an idea of the sexual practices of those people using the Chlamydia- OCCP to inform a future large scale trial. For example, if a proportion of females reported anal intercourse in the sexual history section, and they had come through the NCSP or had not reported this in clinic, then this would indicate an area that needed to be developed as if they had rectal chlamydia as well as genital chlamydia they should be treated with doxycycline 100mg b.d. for a week(298;300).

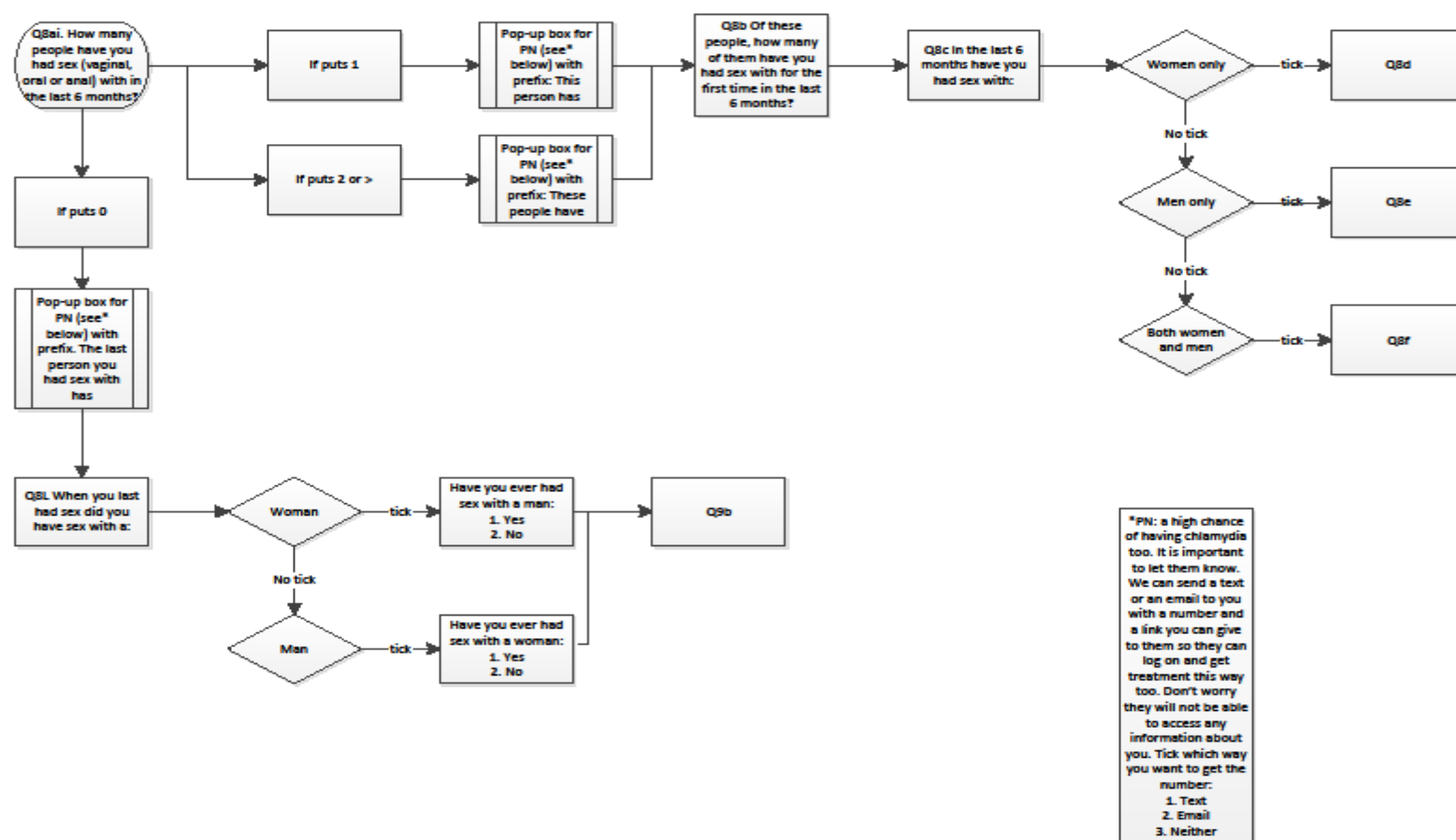
Initially patients are asked whether they have had chlamydia before. If they answer yes to this question, they are then asked when they were last diagnosed with chlamydia. As well as informing us as to the STI history of patients using the online consultation, it also helps us to detect those patients who have tested positive within the past 6 weeks and who have tested again too soon. As is recommended in the BASHH guidelines, patients are also questioned as to whether they have ever tested for HIV, when was the last time they tested and what was the result(298).

I developed the sexual behaviour section separately for women, men who have sex with women, men who have sex with men, and men who have sex with men and women. An example of the logic behind one of the questions is illustrated in Figures 26, 27 and 28 below. As well as asking the number of sexual partners a patient has had in the last six months, they are also asked the number of new partners the patient has had in the last six months. Change in sexual partner and having more than one partner concurrently are risk factors for chlamydia



infection (300;343). I have designed the online clinical consultation so that all patients are asked the appropriate questions for gender of partner/s, type of sex and condom use. The questions asked in the sexual history section of the online clinical consultation are shown in Tables 60 and 61 below.

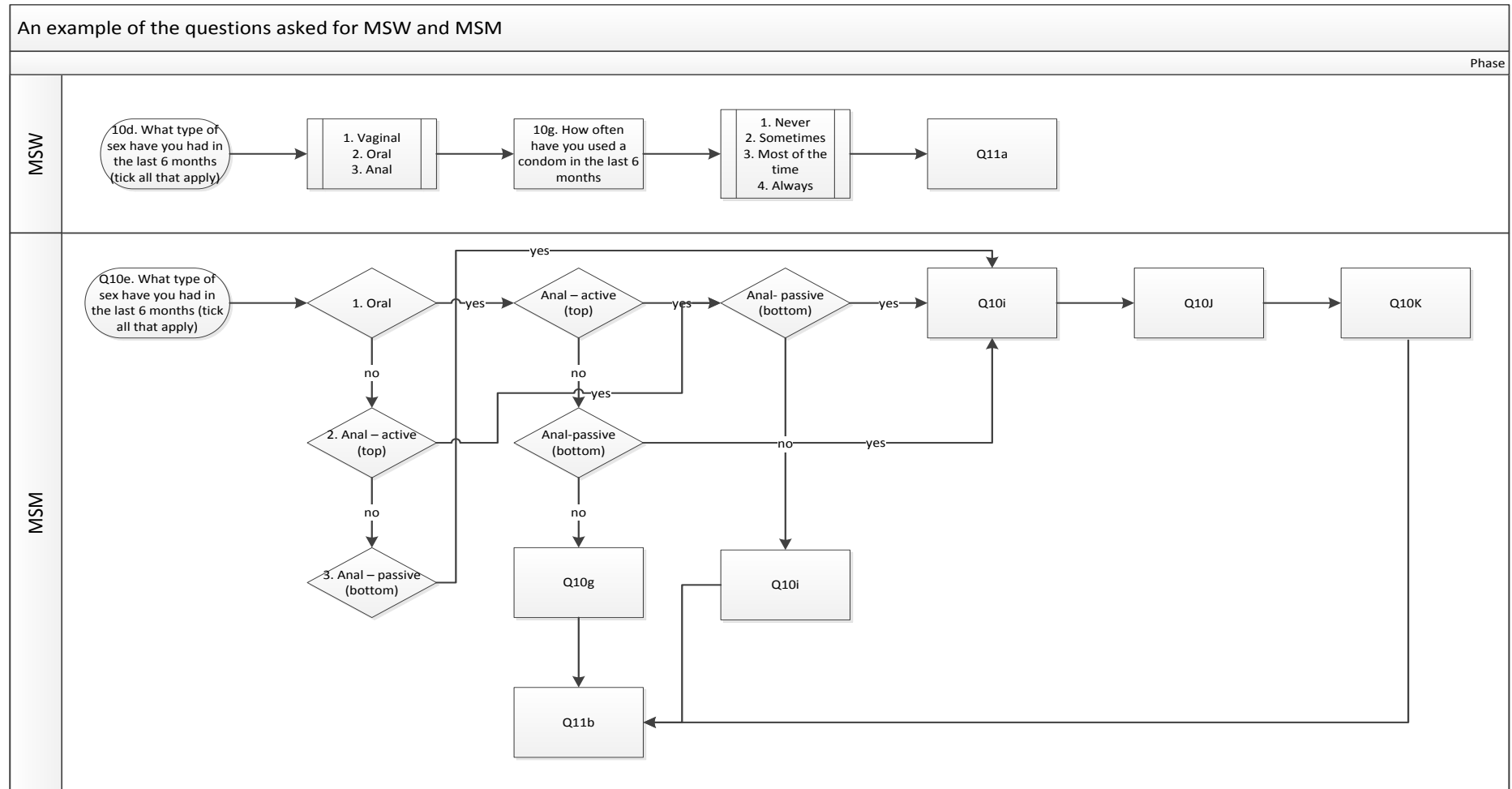
Figure 26: an example of the questions asked as part of the female sexual history



**Men who have sex
with men and
women**



Figure 28: An example of the questions asked for MSW and MSM



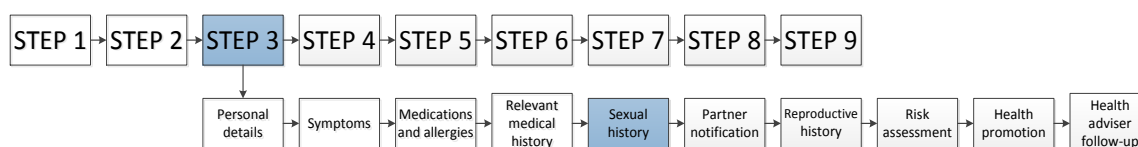
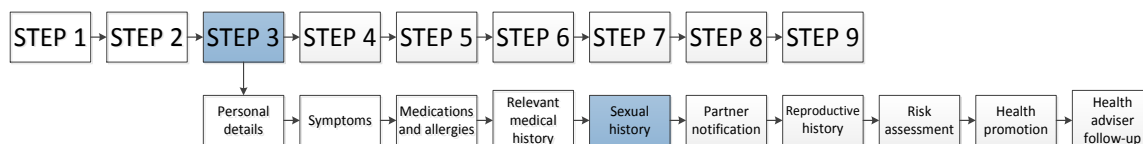
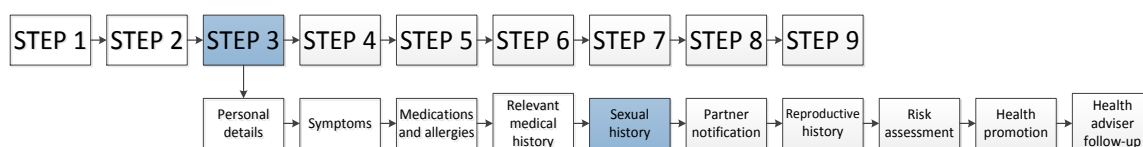


Table 60: Sexual history section (Female) of the online clinical consultation

Data Item	Description	Field Name	Response categories and coding structure
6	Female: Previous chlamydia infection	FPRECHL	<p>Text: Finally, we are going to ask you some standard questions we ask in clinic about your sexual health.</p> <p>Have you ever had chlamydia?</p> <ol style="list-style-type: none"> 1. Yes <i>If ticked yes to chlamydia proceed to 6a</i> 2. No <i>go to 7</i>
6a	Timing of previous Chlamydia infection	TIMEPVCHL	<p>Text: When were you last diagnosed with chlamydia?</p> <ol style="list-style-type: none"> 1. 0-6 weeks 2. 6 weeks - 6 months 3. 7-12 months 4. More than a year ago
7	Previously tested for HIV	PREHIV	<p>Text: Have you ever been tested for HIV?</p> <ol style="list-style-type: none"> 1. Yes <i>(it ticked drop down to 7a and 7b before 8)</i> 2. No 3. Don't know <p><i>(2 and 3 if ticked auto generates to 8ai)</i></p>
7a	Last HIV test	HIVTEST	<p>When was the last time you were tested?</p> <ol style="list-style-type: none"> 1. Within the last 6 months 2. 6-12 months ago 3. More than a year ago
7b	Result of previous HIV test	PREHIVRST	<p>What was the result of the test?</p> <ol style="list-style-type: none"> 1. Negative (you don't have HIV) 2. Positive (You do have HIV) 3. Don't know



Data item	Description	Field Name	Response categories and coding structure
8ai	Number of sex partners in last 6/12	SEXPART	How many people have you had sex (vaginal, oral or anal) with in the last 6 months? - - Number populated to Health adviser follow up screen. If put 0 auto generates to 8f any other number auto generates to 8b after 8aii pop up box saying following: For 0 The last person you had sex with has For 1 person: This person has For more than 1 These people have a high chance of having chlamydia too. It is important to let them know. We can send a text or an e-mail to you with a number and a link you can give to them so they can log on and get treatment this way too. Don't worry they will not be able to access any information about you.
8aii	Partner notification text or e-mail requested	PARTNER NOTIFICATIONREQUEST	Select which way you want to get the number: 1.Text 2.e-mail 3. Neither <i>When ticked automatically generates a text/e-mail to the person.</i>
8b	Number of first time sex partners in last 6/12	NEWSXPART	Of these people, how many of them have you had sex with for the first time in the last 6 months? --



Data item	Description	Field Name	Response categories and coding structure
8 c	Previous sex with women or men or both	GENDERSXPART	Text :In the last 6 months have you had sex with 1. Men only 2. Both men and women 3. Women only
8d	Type of sex	TYPESEX	What type of sex have you had in the last 6 months (tick all that apply) 1. Vaginal 2. Oral 3. Anal
8e	Condom use	CONDOM	How often have you used a condom in the last 6 months? 1. Never 2. Sometimes 3. Most of the time 4. Always Move on to Q9a
8f	Over 6 months sex partners	SIXSEXPART FSEXMAN FSEXBIWO FSEXWOMAN FSEXBIMAN	This question is only for those who put 0 to Q8ai When you last had sex did you have sex with a 1. Man if tick drops down box Have you ever had sex with a woman 1.Yes (to 9a) 2.No (to 9a) 2. Woman if tick drops down box Have you ever had sex with a man 1.Yes (to 9a) 2.No (if ticked go to 9b)

Table 61: Sexual history section (male) of online clinical consultation

Data Item	Description	Field Name	Response categories and coding structure
6	Male: Previous chlamydia infection	MPREVCHL	<p>Text: Finally, we are going to ask you some standard questions we ask in clinic about your sexual health.</p> <p>Have you ever had chlamydia?</p> <ol style="list-style-type: none"> 1. Yes <i>If ticked yes proceed to 6a</i> 2. No <i>go to 7</i>
6a	Timing of previous chlamydia infection	MTIMEPVCHL	<p>When were you last diagnosed with chlamydia?</p> <ol style="list-style-type: none"> 1. 0-6 weeks 2. 6 weeks -6 months 3. 7-12 months 4. More than a year ago

Data item	Description	Field Name	Response categories and coding structure
7	Previously tested for HIV	MPREHIV	<p>Text: Have you ever been tested for HIV?</p> <ol style="list-style-type: none"> 1. Yes (<i>it ticked drop down box to 7a</i>) 2. No 3. Don't know <p><i>(2 and 3 if ticked auto generates to 8ai)</i></p>
7a	Last HIV test	MHIVTEST	<p>When was the last time you were tested?</p> <ol style="list-style-type: none"> 1. Within the last 6 months 2. 6-12 months ago 3. More than a year ago

7b	Result of previous HIV test	MPREHIVRST	<p>What was the result of the test?</p> <ol style="list-style-type: none"> 1. Negative (you don't have HIV) 2. Positive (You do have HIV) 3. Don't know

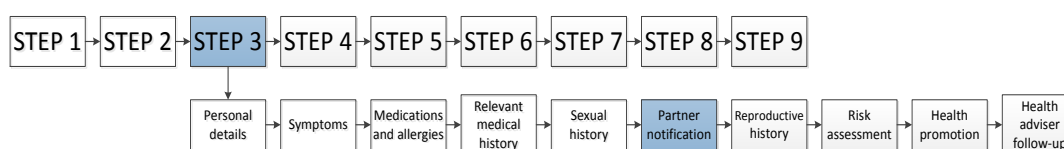
Data item	Description	Field Name	Response categories and coding structure
8ai	Number of sex partners in last 6/12	MSEXPART	<p>How many people have you had sex (vaginal, oral or anal) with in the last 6 months? - - Number populated to health adviser follow up screen.</p> <p>If put 0 auto generates to 8f any other number auto generates to 8b after 8aai pop up box saying following:</p> <p>For 0 The last person you had sex with has</p> <p>For 1 person: This person has</p> <p>For more than 1 These people have</p> <p>a high chance of having chlamydia too. It is important to let them know. We can send a text or an e-mail to you with a number and a link you can give to them so they can log on and get treatment this way too. Don't worry they will not be able to access any information about you.</p> <p>Tick which way you want to get the number:</p> <ol style="list-style-type: none"> 1.Text 2.e-Mail
8aai	Partner notification text or e-mail requested	MPARTNER NOTIFICATIONREQUEST	

			<p>3. Neither</p> <p>When ticked automatically generates a text/e-mail to the person.</p>
8b	Number of first time sex partners in last 6/12	MNEWSXPART	Of these people, how many of them have you had sex with for the first time in the last 6 months? (numerical) - - -
8 c	Previous sex with women or men or both	MGENDERSXPART	<p>Text :In the last 6 months have you had sex with</p> <p>(Tick box)</p> <ol style="list-style-type: none"> 1. Women only If ticked go to Question 8d and 8g then move to Q9a 2. Men only If ticked go to 8e then go to 8i or 8j 3. Both men and Women If ticked go to 8f then 8h
8d	Type of sex Women only	MTYPESEX	<p>What type of sex have you had in the last 6 months (tick all that apply)</p> <ol style="list-style-type: none"> 1. Vaginal 2. Oral 3. Anal
8 e	Type of sex Men only		<p>What type of sex have you had in the last 6 months? (tick all that apply)</p> <ol style="list-style-type: none"> 1. Oral Yes/No If yes to oral and no to 2and3 go to 8g then 9b 2. Anal-active (top) Yes/No... 3. Anal-passive (bottom) Yes/No <p>If answers yes to 8e2 and no to 8e3 then goes to 8i and then 9b.</p> <p>If answers yes to 8e2 and yes to 8e3 then goes to through 8i-8k and then 9b</p> <p>If answers no to 8e2 and yes to 8e3 then goes to 8j to 8k and then 9b</p>

Data item	Description	Field Name	Response categories and coding structure
8f	Type of sex Men and Women	MBISEX	<p>What type of sex have you had in the last 6 months (tick all that apply)</p> <ol style="list-style-type: none"> 1. Oral Yes/No 2. Vaginal Yes/No 3. Anal with a female Yes/No 4. Anal with a man – active (top) Yes/No 5. Anal with a man -passive (bottom) Yes/No <p>If yes to any combination of 1-3 and no to 4 and 5 then goes to 8g and then 9b</p> <p>If yes to any combination of 2-3 and yes to 4 and no to 5 then goes to 8h and then 8i and then 9b</p> <p>If yes to any combination of 2-3 and yes to 4 and 5 then goes to 8h, 8i, 8j, 8k and then 9b</p> <p>If yes to any combination of 2-3 and no to 4 and yes to 5 then goes to 8h then 8j, 8k and then 9b</p> <p>If yes to 4 and no to 2,3 and 5 then goes to 8i and then 9b</p> <p>If yes to 4and5 and no to 2-3 then goes through 8i-8k and then to 9b</p> <p>If yes to 5 and no to 2-4 then goes to 8j, then 8k and then 9b</p>
8g	Condom use	MCONDOM	<p>How often have you used a condom in the last 6 months?</p> <ol style="list-style-type: none"> 1. Never 2. Sometimes 3. Most of the time 4. Always

Data item	Description	Field Name	Response categories and coding structure
8h	Condom use Men and Women	CONMENandWOM	<p>How often have you used a condom in the last 6 months when you had vaginal sex? (tick box)</p> <ol style="list-style-type: none"> 1. Never 2. Sometimes 3. Most of the time 4. Always
8i	Condom use men only -active	CONMENACT	<p>How often have you used a condom in the last 6 months when you were active (top)? (tick box)</p> <ol style="list-style-type: none"> 1. Never 2. Sometimes 3. Most of the time 4. Always
8j	Condom use men only passive	CONMENPASS	<p>How often have you used a condom in the last 6 months when you were passive (bottom)? (tick box)</p> <ol style="list-style-type: none"> 1. Never 2. Sometimes 3. Most of the time 4. Always

Data item	Description	Field Name	Response categories and coding structure
8k	Passive Men Only Condom use	PASSMENCON	Thinking about when you have been passive (bottom), how many partners have you not used a condom with in the last 6 months? (numerical) - - -
8L	Over 6 months sex partners	MSIXSEXPART MSEXWOMAN MSEXBIMAN MSEXMAN MSEXBIWO	This question is only for those who put 0 to Q8a When you last had sex did you have sex with a <ol style="list-style-type: none"> 1. Woman if tick drops down box Have you ever had sex with a man 1.Yes 2.No 2. Man if tick drops down box Have you ever had sex with a woman 1.Yes 2.No On to 9b



Partner notification

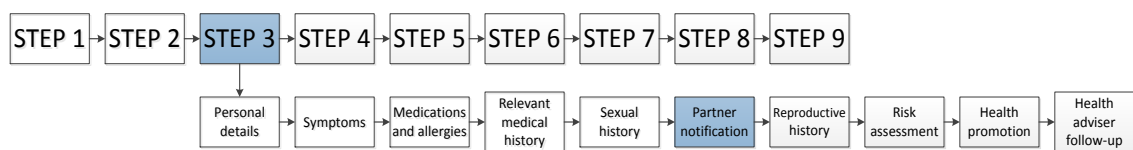
Objective

To advise patients of the need to contact sexual partners to inform them that they are a contact of chlamydia and to provide a method whereby sexual partners can access epidemiological treatment online via the Chlamydia-OCCP.

Evidence

It remains unclear which is the optimal method of partner notification for people diagnosed with *Chlamydia trachomatis* (344). Currently only 40-60% of relevant named sexual partners are managed appropriately (345). In England, the most common method used by patients to inform their partners of their potential exposure to an STI is via ‘patient referral’, in which patients inform their sexual partners that they may have been in contact with an infection and need to access medical care (346). Although new mechanisms of informing partners are available, for example by text or SMS, these have been found to be less popular than may have been anticipated (347).

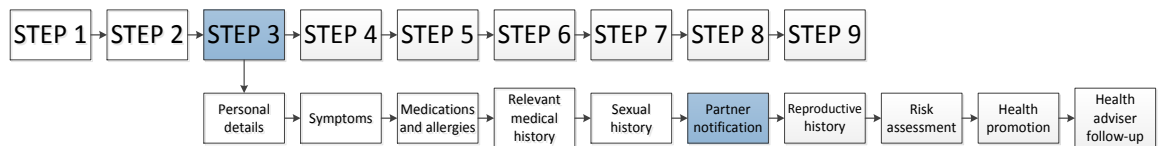
Expedited partner therapy, one form of which is patient delivered partner therapy, is the method whereby an index patient is given treatment to give to sexual partners who may have been in contact with the infection with which they have been diagnosed. It has been trialled with indexes who have been diagnosed with genital *Chlamydia trachomatis*, *Trichomonas vaginalis* and *Neisseria gonorrhoea*, and has been shown to be a successful method of treating partners of indexes in countries outside the UK (344;348). However, current UK prescribing guidance recommends that a medical assessment is conducted for a person prior to them being prescribed Azithromycin (260;261;296). In addition, both a recent Cochrane Collaboration Intervention review of strategies for partner notification for sexually transmitted



infections, and a health technology assessment conducted by Althaus et al, found that although patient delivered partner therapy was superior to patient referral for reducing rates of reinfection in the index patient, it did not surpass enhanced patient referral in efficacy (344;349). They found that there is currently insufficient evidence to discern the most effective method of enhanced partner referral for specific settings (349).

Decision

In our exploratory study we agreed among the research team that we wanted to explore partner notification via an online model but that it was not the primary outcome of the study. We adopted a pragmatic approach, keeping the partner notification offered as patient referral, whilst acknowledging the potential for the Chlamydia-OCCP to provide “provider” referral/anonymised partner notification in the future). In the UK, a different form of expedited partner therapy has been developed, “Accelerated Partner Therapy (APT)” which is showing promise in preliminary studies (296). For the purposes of this trial, it was decided to use a simplified version of a method already being used in an existing trial (APT trial (UKCRN numbers 2564 and 10123)) to facilitate partner notification, along with website guidance. It is beyond the scope of the exploratory trials to send participants’ sexual partners an anonymous text. Instead, participants will be emailed or text (depending on their preference) a message containing a link and unique number (to that participant) that sexual partners will be able to use to access the online clinical consultation and potentially treatment online. This will be followed up, as is standard practice in the UK, by a phone call from a health advisor at two weeks.



In order to optimise the flow of the online consultation, we chose to include the partner notification section straight after the first sexual health question: ‘How many people have you had sex with in the last six months?’

Those patients who have been diagnosed with chlamydia and have not had sex in the last six months need to contact the last person they have had sex with. Therefore, anyone answering zero to the above question, is still directed to the partner notification page and is then asked the following set of questions:

When you last had sex did you have sex with a

3. *Man (if tick drops down box)*

Have you ever had sex with a woman?

1.Yes 2.No

2. *Woman (if tick drops down box)*

Have you ever had sex with a man?

1.Yes 2.No

Figure 29 is a screenshot of the partner notification screen.

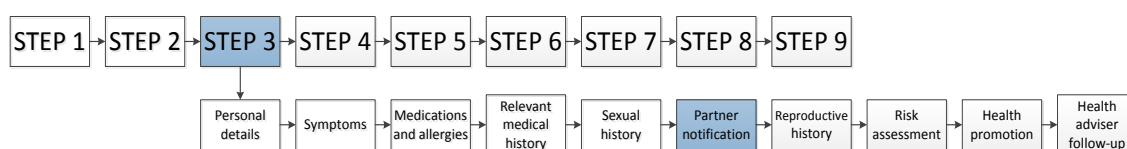
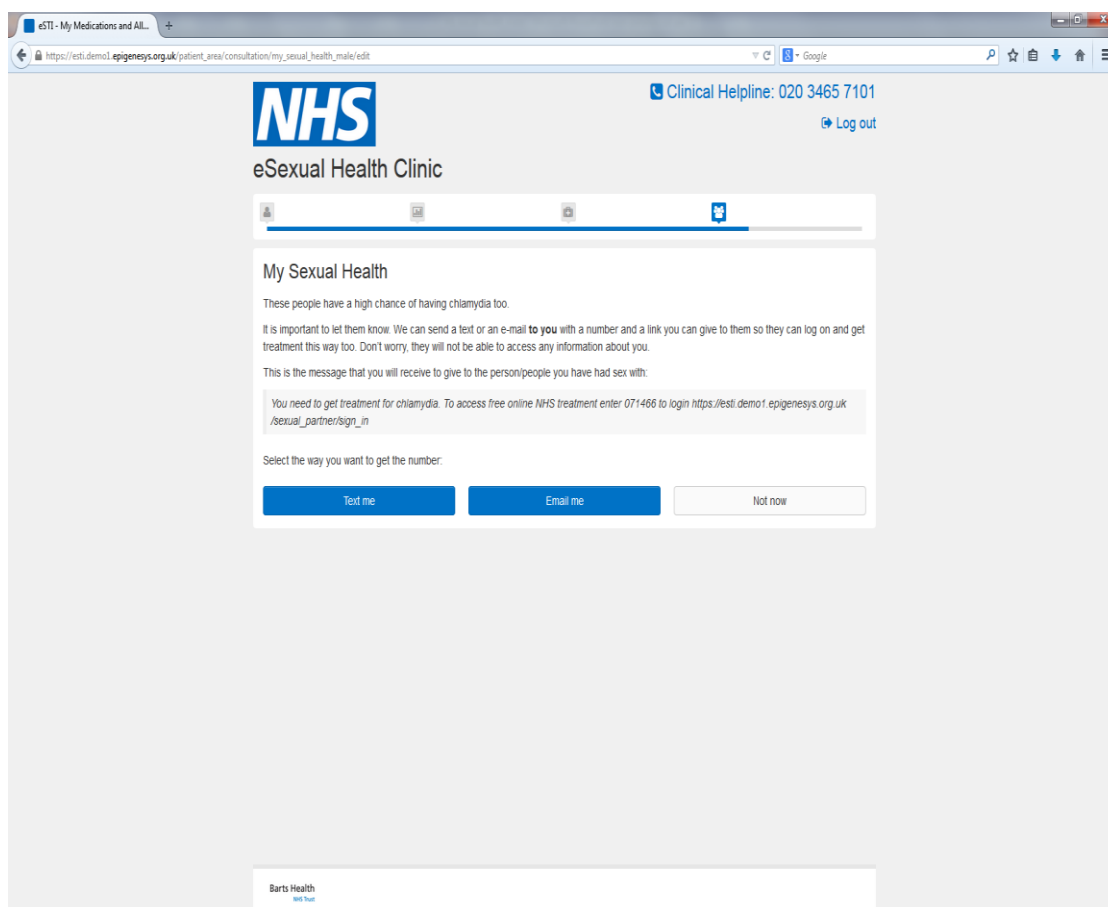


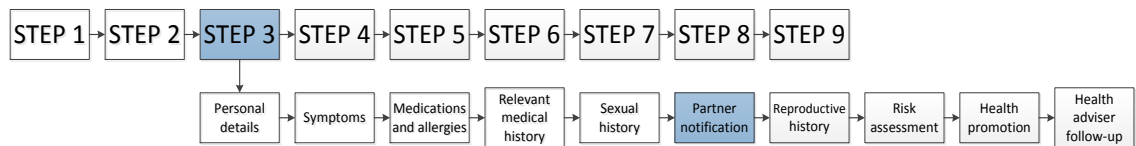
Figure 29: Screenshot of partner notification screen



I adjusted the wording of the first sentence for the combinations illustrated in Table 62.

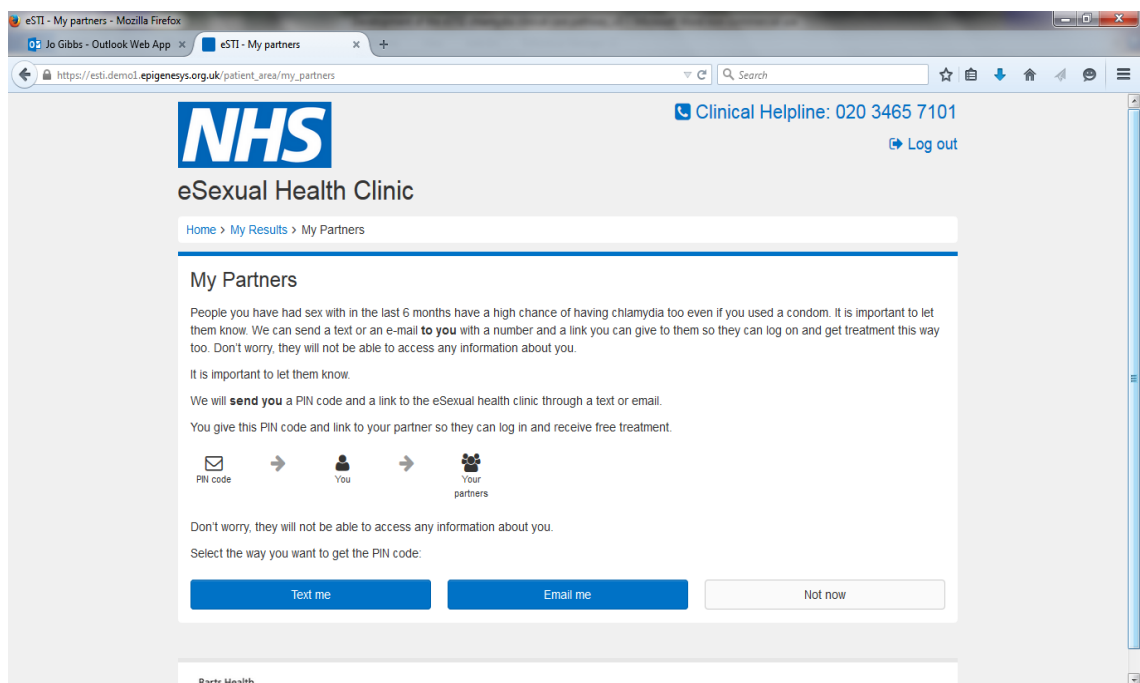
Table 62: Wording of partner notification page

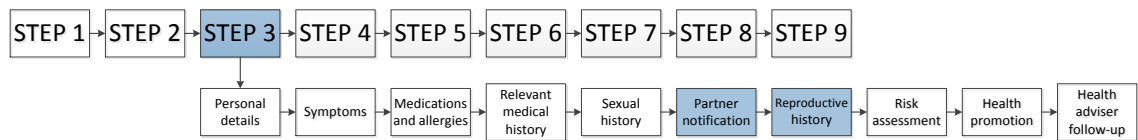
No of sexual partners in the last 6 months	Wording of first sentence
0	The last person you had sex with has a high chance of having chlamydia too
1	This person has a high chance of having chlamydia too
2 or more	These people have a high chance of having chlamydia too



Early evaluation, conducted three months into the study, revealed that few index patients were choosing to have a partner notification text or email sent to them and only three sexual partners had accessed the online service. I collated the data collected from the health adviser follow-up interviews, health adviser notes and discussed the issue with the qualitative researcher. I then arranged to meet with a senior researcher and the human computer interface researcher so that we could revise the partner notification page and the partner notification text/email message. We decided to reduce the wording and introduce a diagram to illustrate what we were trying to convey. I revised the text message and cognitively tested (see Step 5) several versions with clinic patients. The final partner notification screen is shown below in Figure 30.

Figure 30: Screenshot of the final partner notification screen





The revised partner notification message that was sent to the index patient via SMS or email was:

‘To access free online NHS treatment enter 034542 to login

<https://esh.bartshealth.nhs.uk/sexualpartner>’

A couple of weeks after implementing this, the research health adviser raised concerns that patients still did not fully understand how this worked. I therefore revised the health adviser follow-up questions so that we could capture this information. In the five months following the change in the partner notification screen, 25 sexual partners accessed the online consultation. A process evaluation using the quantitative and qualitative data (see Chapter 6) will be conducted to inform a full-scale trial.

Reproductive history

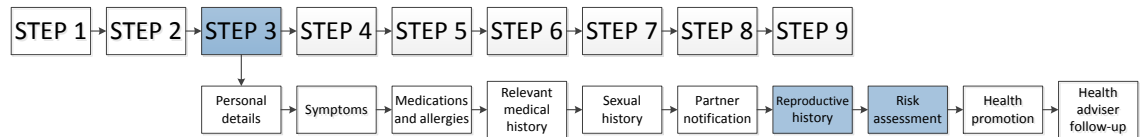
Objective

For the purposes of the Chlamydia-OCCP study, a reproductive history was required to identify those patients who are pregnant or breast feeding

Evidence

A reproductive history is taken from females when they attend a sexual health clinic to identify(298;340):

1. those women who are pregnant which may alter management of conditions diagnosed
2. those women who may be pregnant and who need a pregnancy test and an assessment for emergency contraception



3. whether a female needs contraception and what are her options from a medical perspective
4. whether a female is using the contraception method she is using correctly
5. women with abnormal menstrual patterns and changes in pattern who require further investigation
6. Women who are not up-to-date with their cervical cytology or have a history of abnormal cervical smears

Decision

I initially drafted an assessment to establish if a woman had unmet contraceptive needs, was at risk of pregnancy or was eligible for emergency contraception. However, we decided that this was outside the remit of our proof of concept Chlamydia-OCCP exploratory study. Instead I chose to ask whether a female patient whether she is pregnant or breast-feeding. Although these women could potentially be managed online, as this is an exploratory study, we decided that these would be directed off the pathway and into clinic (shown in Figure 31 below).

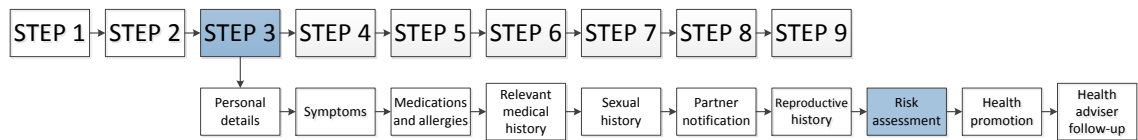
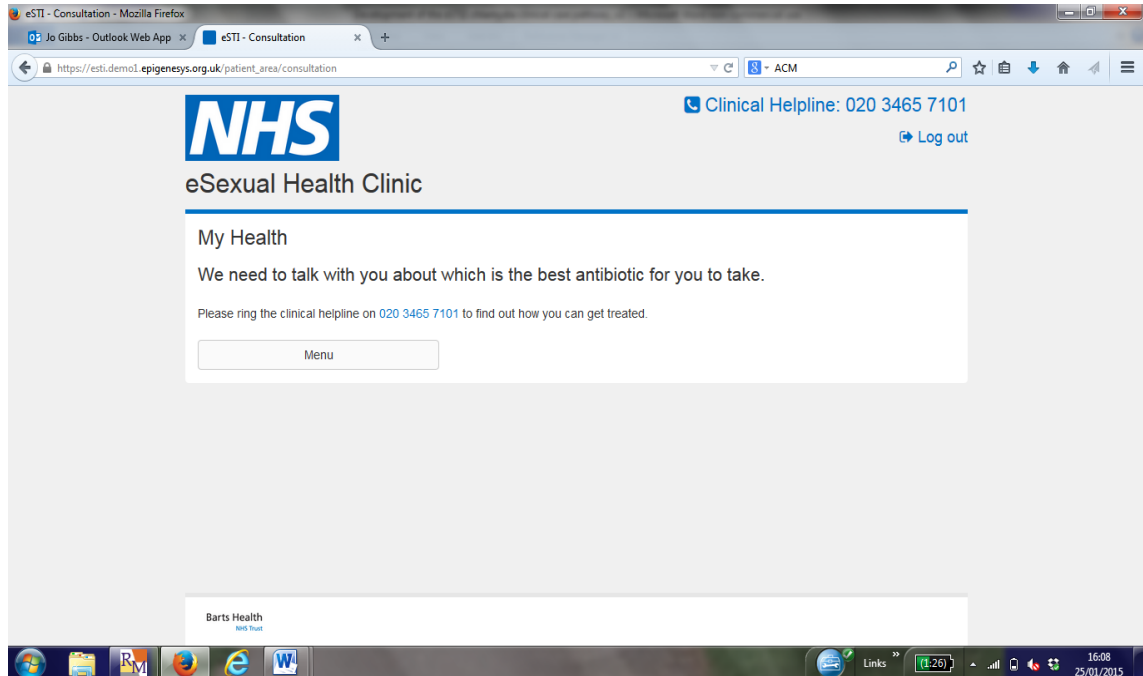


Figure 31: Screenshot from patient who has fallen off the pathway because she is pregnant or breast-feeding.



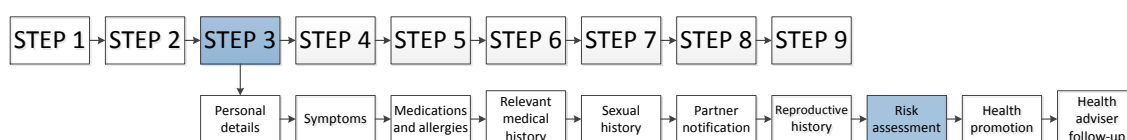
Risk assessment

Objective

To conduct a risk assessment to identify patients who are at higher risk of other infections or getting recurrent infection in the future.

Evidence

All patients who are screened for STIs are recommended to undergo a risk assessment for blood borne viruses(298). Those patients who are recruited from the GUM clinics will have had a risk assessment at their initial appointment however those patients recruited from the NCSP will not have had one. There is also evidence to suggest that people are more likely to be candid when answering sensitive questions in a computer assisted structured interview than in a face-to-face interview (40;151;152;155).



Decision

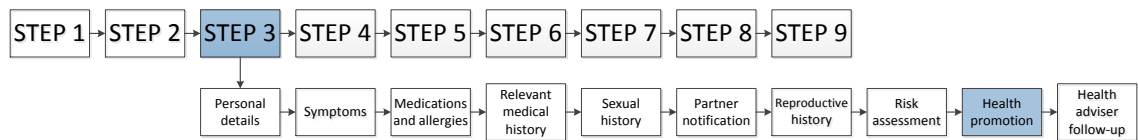
Table 63 below shows which questions I chose to include in the online clinical consultation and how I have phrased them.

Table 63: Risk assessment questions

Gender	Question
Female	Have any of your male partners had sex with a man?
Male(MSW only)	Have you ever had sex (oral or anal) with a man?
Female and Male	Have you ever injected drugs or had sex with someone who has injected drugs?
Female	Have you ever received money or paid money for sex?
Male	Have you ever paid money or received money for sex?
Female and Male	Have you ever had sex with someone from a different country (outside of the UK and Ireland)? <i>If yes, please list the country or countries here</i>
Female and Male	Have you ever been vaccinated against Hepatitis B?

As part of the health adviser two week follow-up, all patients who answered yes to any of these questions were asked additional questions as part of the follow-up. In addition, health advisers were able to see patients responses to the online consultation and were therefore able to identify high risk individuals who may benefit from one-to-one interventions, along with young people who were in a relationship with a much older partner.

All patients should be asked if they have ever had non-consensual sex and be assessed as to whether they are in a physically or mentally abusive relationship, use recreational drugs or have alcohol problems. The expert group and the members of the public involved in cognitive testing both felt that it would be too emotive to ask about non-consensual sex in an online



consultation. Instead, I chose to add information about where to access help for this in the health promotion section. Asking about recreational drug and alcohol use was beyond the scope of the study, which is a limitation, however it should be included in a future large scale trial.

Health promotion

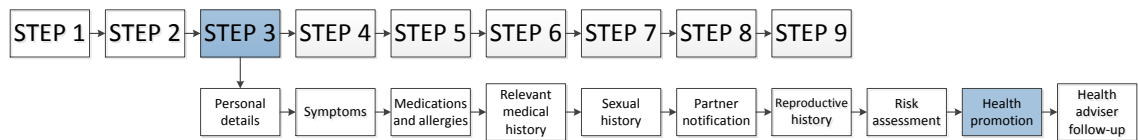
Objective

To provide users with information about sexual health, safe sex and contraception.

Evidence

Although the incidence of STIs in the UK decreased by 0.6% between 2012 and 2013, diagnoses of some STIs continues to increase, and young people and MSM remain disproportionately affected(97). Lim et al, in their survey of young people attending a music festival in Melbourne, found only a small improvement in STI knowledge between 2006 and 2011. The statements that were most frequently answered incorrectly were to do with diagnosis and treatment, with 65% of young people believing that pap smears can diagnose all the main STIs, only 53% aware that chlamydia can be diagnosed using a urine test and 51% aware that gonorrhoea, chlamydia and syphilis can all be treated with antibiotics(350).

There has been a call to improve sexual health promotion interventions and to use the internet and mobile phones to reach young people (350-352). A 2011 Cochrane review found that interactive computer-based interventions are an effective way of educating young people on sexual health and can have a beneficial effect on sexual behaviour. However, it concluded that further evidence was required to demonstrate cost-effectiveness, impact on biological outcomes, and how these interventions might work(353). Since then, a number of studies have used the internet, social media, and SMS to provide sexual health promotion to young people



(190;354-356). Jones et al undertook a systematic review of the impact of health education provided via social media or SMS on the sexual behaviour of young people. As with the 2011 Cochrane review, they found that the studies provided evidence on benefit of STI prevention knowledge in this group, but only weak evidence of other benefits, and that many of the studies contained limitations which inhibited their usefulness. They concluded that further research is needed in this field (355).

Decision

Health promotion forms a vital part of service provision in sexual health. Designing a novel health promotion section was outside the remit of the study and my PhD. However, I wanted to ensure that we provide patients with the same opportunities to access information on the major components of health promotion as happens within clinic. As patients were to be recruited from both a clinic setting and the NCSP, and would therefore been exposed to different levels of health promotion, I decided to attempt to provide accurate and useful information on all the basic components by using links to existing NHS and accredited Sexual Health sites. Initially I included tailored health promotion information for patients testing positive using the information they entered in the online clinical consultation to guide what additional information was provided. However, it was not feasible to implement this in our proof of concept study.

Figure 32 below shows the health promotion page in the online consultation, which is available to people testing positive and negative for chlamydia.

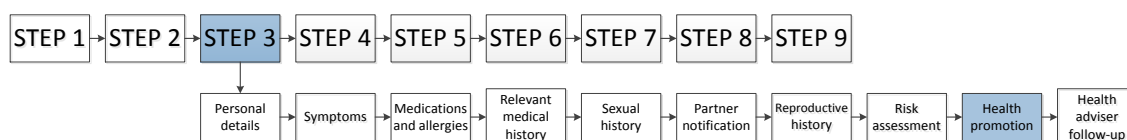
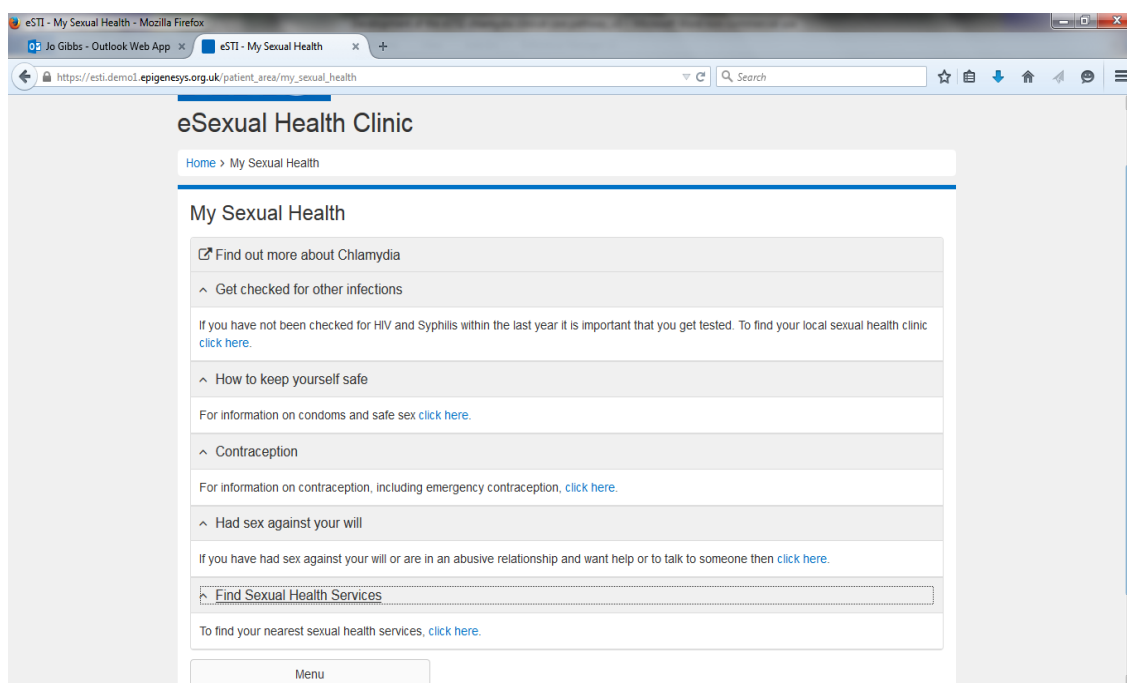


Figure 32: Screenshot of health promotion page



The websites that patients are directed to are listed in Table 64 below.

Table 64: Web links for health promotion page

Health Promotion Heading	Web link
Find out more about chlamydia	http://www.fpa.org.uk/helpandadvice/sexuallytransmittedinfectionsstis/chlamydia
Get checked for other infections	www.nhs.uk/ServiceDirectories/Pages/ServiceSearchAdditional.aspx?ServiceType=SexualHealthService
How to keep yourself safe	http://www.bashh.org/documents/4239.pdf
Contraception	www.fpa.org.uk

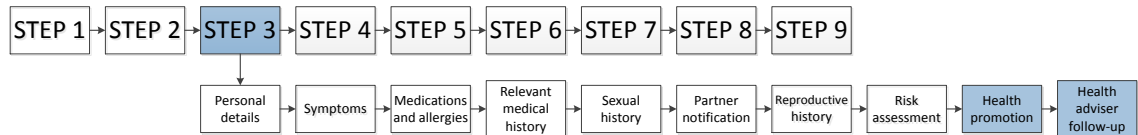


Table 64 continued

Health Promotion Heading	Web link
Had sex against your will	www.rapecrisis.org.uk/Referralcentres2.php
Find Sexual Health Services	www.nhs.uk/ServiceDirectories/Pages/ServiceSearchAdditional.aspx?ServiceType=SexualHealthService

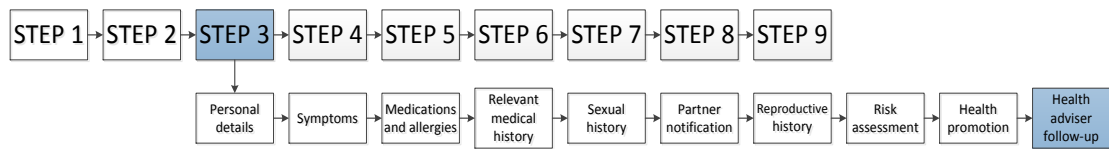
Patients testing negative for chlamydia are provided with information about the window period for chlamydia testing and are advised that they need to repeat the test if they have had sex with a new sexual partner in the preceding two weeks. As the NCSP patients will not have been tested for HIV, syphilis and, in some cases gonorrhoea, negative patients are also advised that they may be at risk of other STIs and are directed to the health promotion page for information on other STIs, contraception, and safe sex.

Health-adviser follow-up consultation

This is the last unit and is the only section aimed at completion by a healthcare professional and not directly by the patient.

Objective

To develop a health adviser follow-up consultation that covers all elements of a traditional consultation, adapted to the needs of a remote consultation.



Evidence

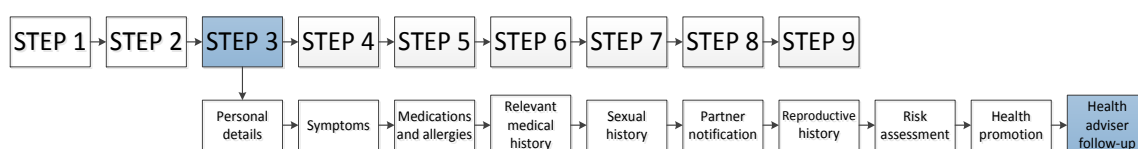
There are clear guidelines on the content of a health adviser consultation with a patient diagnosed with genital chlamydia (300;357-359). These include ensuring that the patient has had effective treatment, has not had sexual intercourse within a week of treatment or with an untreated partner, and a discussion around partner notification(300).

Decision

Although the health adviser follow-up is conducted by phone, it is part of the eSexual Health Clinic and the health adviser is able to access their own screens and reports. The follow-up is an electronic proforma that forms part of each patient's electronic health record. Each person who tests positive for chlamydia and consents to the study will be followed up two weeks after their results text is sent to them.

I designed the proforma so that it captured all the information necessary to ensure that the patient had been successfully treated, had not been potentially re-exposed to infection, and that we had details and outcomes on all sexual partners that needed to be notified. As well as requiring this information to ensure appropriate management of all patients and sexual partners, we also needed to feedback this information to the relevant GUM clinic or NCSP site.

If patients had reported that they had genital lumps or genital sores, rash or blisters, then an additional screen appeared in the health adviser follow-up so that the health adviser could discuss these symptoms and arrange a clinical review if necessary. Likewise, if patients answered yes to any of the questions in the risk assessment then an additional screen appeared so that the health adviser could discuss this and direct them to clinical services if necessary.



The quantitative service evaluation, discussed in Chapter 6, was added onto the end of the health adviser follow-up consultation.

Table 65 below shows the original health adviser follow-up, with Table 66 showing the health follow-up after adjustments had been made on the partner notification section (as discussed on page 239).

Table 65: Original health adviser follow-up

Data item	Description	Field name	Response categories and coding structure
1	Date of index follow up	IDATEFU	HA inserts ID number 1 DD/MM/YYYY 2 DD/MM/YYYY 3 DD/MM/YYYY Start and end Time of consultation auto-generated stops automatically when closed (3 attempts for follow up will be made to each index, so need date, start and end time for each)
2.	Index treated	INEXTREATED	1. Yes (if yes automatically feeds to 2.i) 2. No (if no automatically feeds to 2.vii)

Data item	Description	Field name	Response categories and coding structure
2.i	When index treated	IWHENTREAT	Drop down box with: <ol style="list-style-type: none"> 1. Same day as received result 2. 1 day after received result 3. 2 days after receiving result 4. 3 days after receiving result 5. 4 days after receiving result 6. 5 days after receiving result 7. 6 days after receiving result 8. 7 days after receiving result 9. More than 1 week after receiving result
2.ii	Where index treated	IWHERE TREAT	Drop down box with: <ol style="list-style-type: none"> 1. Via online clinical consultation at chosen pharmacy 2. In a sexual health clinic 3. At GPs 4. At pharmacy 5. Family Planning Clinic/CASH 6. Other – free text
2.iii	Vomited within 2 hours of taking azithromycin	IVOMIT	<ol style="list-style-type: none"> 1. Yes (if yes automatically feeds to 2.iiia) 2. No (if no automatically feeds to 2.iv)
2.iiia	Has patient been retreated	IRETREAT	<ol style="list-style-type: none"> 1. Yes (if yes automatically feeds to 2.iv) 2. No (if no automatically feeds to 2.vii)
2.iv	Any other problems/side-effects with treatment	ISIDEEF	<ol style="list-style-type: none"> 1. Yes (if yes drop down box with free text then feeds to 2.v) 2. No (if no automatically feeds to 2.v)
2.v	Any sexual intercourse (incl oral sex) within 1 week of treatment	IINTERCOUR	<ol style="list-style-type: none"> 1. Yes (if yes automatically feeds to 2.vii) 2. No (if no automatically feeds to 2.vi)
2.vi	Any sexual intercourse (incl oral sex) with	INTERUNTRPT	<ol style="list-style-type: none"> 1. Yes (if yes automatically feeds to 2.vii)

	untreated/inadequately treated partner		2. No (if no automatically feeds to 3)
2.vii	When will they go for (re-)treatment and where	IWHERERETREAT	Free text (Then automatically feeds to 3)
3.	ONLY IF FLAGGED ON ONLINE CONSULTATION Symptoms ticked on online consultation	IHEALTHPROM	Automatically filled from online consultation data item Female 4a, Male 4a. Tick all that apply: 1. Rash, sores or blisters in the genital area 2. Skin lumps in the genital area
3.1	Symptoms resolved?	ISYMRESOLVED	1. Yes 2. No 3. Some improvement but still present
3.2	Advice sought?	IADVICE	1. Yes (if yes, automatically feeds to 3.3) 2. No (if no, automatically feeds to 3.4)
3.3	Where was advice sought?	IWHEREADVI	1. Sexual Health Clinic 2. GP 3. 111 telephone service 4. Clinical helpline 5. Other – free text
3.4	Other information gathered/advice given	IANYADVICE	Free text
4.	ONLY IF FLAGGED ON ONLINE CONSULTATION Discussion about risk factors/HIV/STS/Hep B testing	IDISCUSSHIV	Free text Fed from Females and Male 9a-9d

5.	Number of partners in last 6 months	INOPARTNER	<p>1. Number of sexual partners - - Number of partners populated from index consultation. Females 8ai and males 8ai</p> <p>All questions from 5.1a to 6 to be asked of each sexual partner</p>
5.ia	[Partner 1] partner notified by index	PARTNOT	<p>1. Yes (if yes automatically feeds to 5.ib)</p> <p>2. No (if no automatically feeds to 5.if)</p> <p>.</p>
5.ib	When index notified by partner	WHENNOT	<p>Drop down box with:</p> <ol style="list-style-type: none"> 1. Same day as received result 2. 1 day after received result 3. 2 days after receiving result 4. 3 days after receiving result 5. 4 days after receiving result 6. 5 days after receiving result 7. 6 days after receiving result 8. 7 days after receiving result 9. More than 1 week after receiving result
5.ic	How index notified by partner	HOWNOT	<p>Tick all that apply:</p> <ol style="list-style-type: none"> 1. Face –face 2. Phone call 3. Text message 4. Email 5. Facebook 6. Other – free text
5.id	Did index give PIN and link to online clinical consultation to partner	PINGIVEN	<ol style="list-style-type: none"> 1. Yes (if yes automatically feeds to 5.if) 2. No (if no automatically feeds to 5.ie)
5.ie	Reason why PIN and link not given to partner	REASPINNOT	<ol style="list-style-type: none"> 1. Deleted text prior to informing partner 2. Too embarrassed 3. Partner not interested in online method 4. Forgot to forward text 5. Forgot to forward email 6. Other
5.if	Partner treated (as reported by index)	PARTTREATINDEX	<ol style="list-style-type: none"> 1. Yes (if yes automatically feeds to 5.ig) 2. No (go to 6) 3. Don't know (go to 6)

5.ig	Where partner treated (as reported by index)	WHEREPARTREAT	1. Don't know 2. Via online clinical consultation 3. GP practice 4. Sexual Health clinic 5. Family planning clinic 6. NCSP office 7. Pharmacy 8. Other.... Please state where
5.ih	When partner treated (as reported by index)	WHENPARTREAT	1 Already received treatment Same day 2 1 day after informed 3 2 days after informed 4 3 days after informed 5 4 days after informed 6 5 days after informed 7 6 days after informed 8 7 days after informed 9 8 days after informed 10 9 days after informed 11 10 days after informed 12 11 days after informed 13 12 days after informed 14 13 days after informed 15 14 days after informed 16 Don't know
5.ii	Reason why partner not notified	REASPARTNOTNOT	1. Unable to contact 2. Too embarrassed 3. Not wanting to contact partner 4. Forgot to contact partner 5. Index didn't think they needed to contact partner 6. Other reason – free text
6.	Any other points discussed/information given	DISCUSSION	1. YesFree text box 2. No Move to next partner and ask same questions, after all same questions have been asked about all partners, move to Q7
24	Suitable for qualitative interview	QUALINT	1. Yes – automatically feeds to 25 2. No – system closes date and time recorded
25	Permission to follow-up by researcher	PERMFURESEA	1. Yes 2. No If yes, drop down text box: best time to call for interview

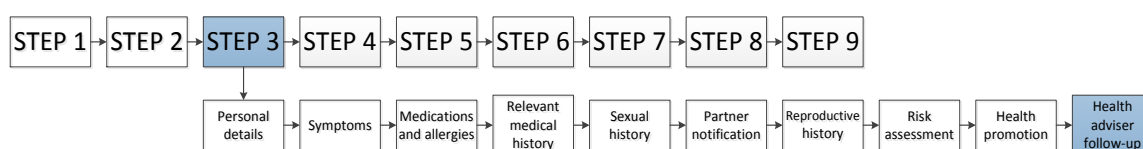


Table 66: Revised Health adviser follow-up from Q5a onwards

Data item	Description	Field name	Response categories and coding structure
5a	Did index give PIN and link to online clinical consultation to partner/s	PINGIVEN	<ol style="list-style-type: none"> 1. Yes (if yes automatically feeds to 5.ai) 2. No (if no automatically feeds to 5.bi) 3. Dropped off consultation before PARTNER NOTIFICATION section (automatically feeds to 5.cia) 4. Chose not to receive PIN and link (automatically feeds to 5.biii)
5ai	Did index patient understand how the PIN and link was to be used (i.e. they should send it to partners so they could receive treatment online too?)	PINUNDERSTAND	<ol style="list-style-type: none"> 1. Yes (automatically feeds to 5bi) 2. No (automatically feeds to 5aii)
5aii	How did the index patient think the PIN and link worked	PINUNDERSTANDET	Free text box
5bi	Reason why PIN and link not given to partner/s	REASPINNOT	<ol style="list-style-type: none"> 1. Deleted text/email prior to informing partner 2. Too embarrassed 3. Partner not interested in online method 4. Forgot to forward text 5. Forgot to forward email 6. Didn't understand what PIN and link were for 7. Other (automatically feeds to 5bii) <p><i>1-6 automatically feed to 5cia</i></p>

Data item	Description	Field name	Response categories and coding structure
5bii	Other reason why PIN and link not given to partner/s	REASPINNOTOTH	Free text
5biii	Reason why index decided not to get PIN and link?	REASPINNOTGET	<ol style="list-style-type: none"> 1. Didn't understand how it would work 2. Preferred to let partner/s know by other method 3. Other (automatically feeds to 5biv) <p><i>1 and 2 automatically feed to 5biv</i></p>
5biv	Other reason why index decided not to get PIN and link	REASPINNOTGETOTH	Free text
5.cia	[Partner 1] partner notified by index	PARTNOT	<ol style="list-style-type: none"> 1. Yes (if yes automatically feeds to 5.ib) 2. No (if no automatically feeds to 5.if)
5.cib	When index notified by partner	WHENNOT	<p>Drop down box with:</p> <ol style="list-style-type: none"> 1. Same day as received result 2. 1 day after received result 3. 2 days after receiving result 4. 3 days after receiving result 5. 4 days after receiving result 6. 5 days after receiving result 7. 6 days after receiving result 8. 7 days after receiving result 9. More than 1 week after receiving result
5.cic	How index notified by partner	HOWNOT	<p>Tick all that apply:</p> <ol style="list-style-type: none"> 1. Face –face 2. Phone call 3. Text message 4. Email 5. Facebook 6. Other – free text
5.cie	Partner treated (as reported by index)	PARTTREATINDEX	<ol style="list-style-type: none"> 1. Yes (if yes automatically feeds to 5.ig) 2. No (go to 6) 3. Don't know (go to 6)

Data item	Description	Field name	Response categories and coding structure
5.cif	Where partner treated (as reported by index)	WHEREPARTREAT	<ol style="list-style-type: none"> 1. Don't know 2. Via online clinical consultation 3. GP practice 4. Sexual Health clinic 5. Family planning clinic 6. NCSP office 7. Pharmacy 8. Other.... Please state where
5.cig	When partner treated (as reported by index)	WHENPARTREAT	<ol style="list-style-type: none"> 1. Already received treatment Same day 2 1 day after informed 3 2 days after informed 4 3 days after informed 5 4 days after informed 6 5 days after informed 7 6 days after informed 8 7 days after informed 9 8 days after informed 10 9 days after informed 11 10 days after informed 12 11 days after informed 13 12 days after informed 14 13 days after informed 15 14 days after informed 16 Don't know
5.cih	Reason why partner not notified	REASPARTNOTNOT	<ol style="list-style-type: none"> 1. Unable to contact 2. Too embarrassed 3. Not wanting to contact partner 4. Forgot to contact partner 5. Index didn't think they needed to contact partner 6. Other reason – free text

A screenshot illustrating the section for patients who report symptoms or high risk sexual behaviour is shown in Figure 33 below.

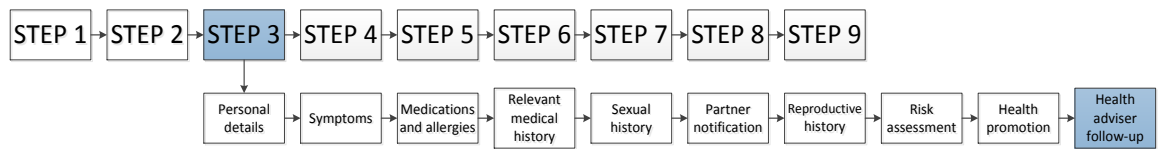


Figure 33: Screenshot of health adviser screen for symptomatic patients and high risk sexual behaviour

FOLLOWUP FOR INDEX PATIENT AKC058925 (RESULTS NO. AKC872805) 07725 528 168

Ask the patient the questions that follow.

Symptoms ticked on online consultation

☐ Rash, sores or blisters in the genital area

☒ Skin lumps in the genital area

☐ Pain In Testes

☐ Pain In Anus

Are your symptoms resolved?

☐ Yes ☒ No ☐ Some improvement, but still present

Have you sought advice?

☐ Yes ☒ No

Any other information given/advice sought

Discussion about risk factors/HIV/STSHep B testing

Only necessary if risk factors from consultation deem it appropriate.

Have you ever had sex (oral or anal) with a man? **N/A**

Have you ever paid for or received money for sex? **Yes**

Have you ever injected drugs or had sex with someone who has injected drugs? **Yes**

Have you ever had sex with someone from a different country (outside of the UK and Ireland)? **Yes**

Please list the country or countries here: **Jamaica**

Have you ever been vaccinated against Hepatitis B? **Yes**

Comments

We decided that there would be three attempts at follow-up before the patient passed into the 'unsuccessful follow-up' screen (see Figure 34 for screenshot). Figure 35 shows the screenshot of patients waiting to be followed up and who are in progress.

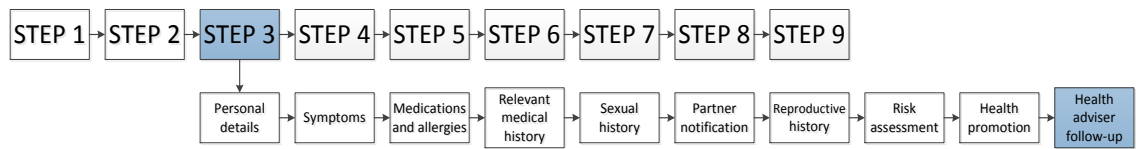
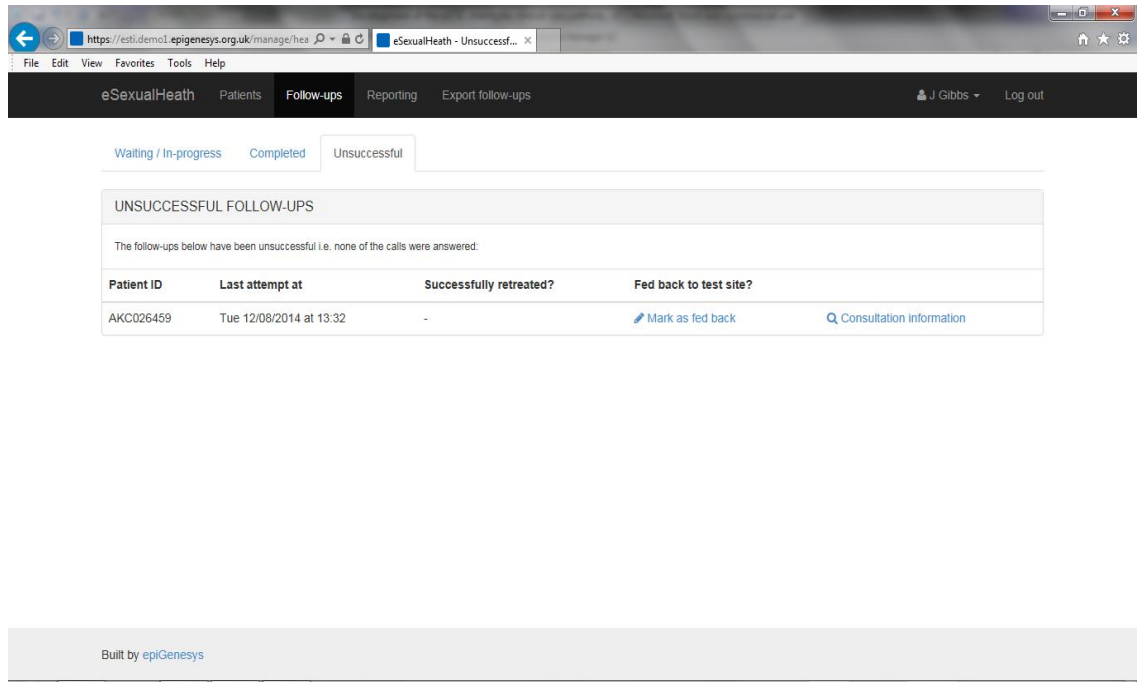


Figure 34: A screenshot of the unsuccessful follow-up screen



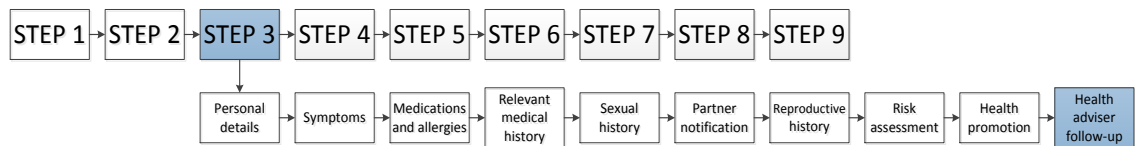
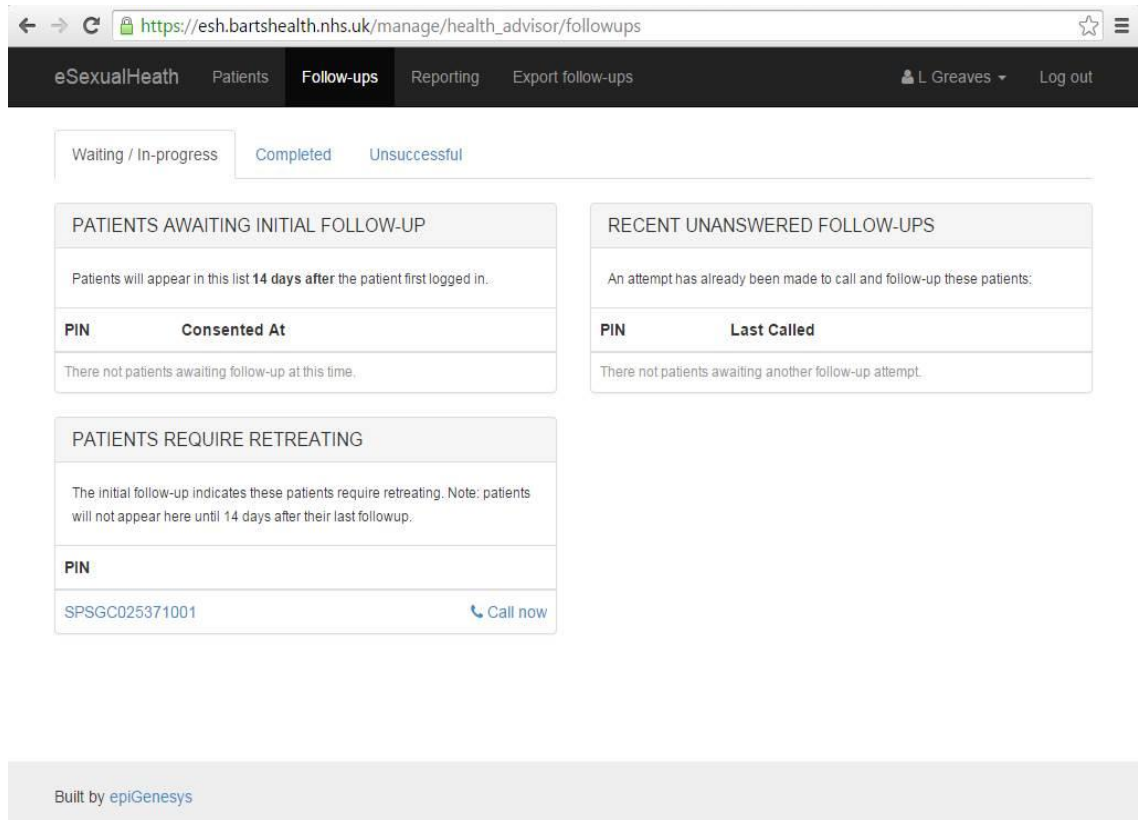
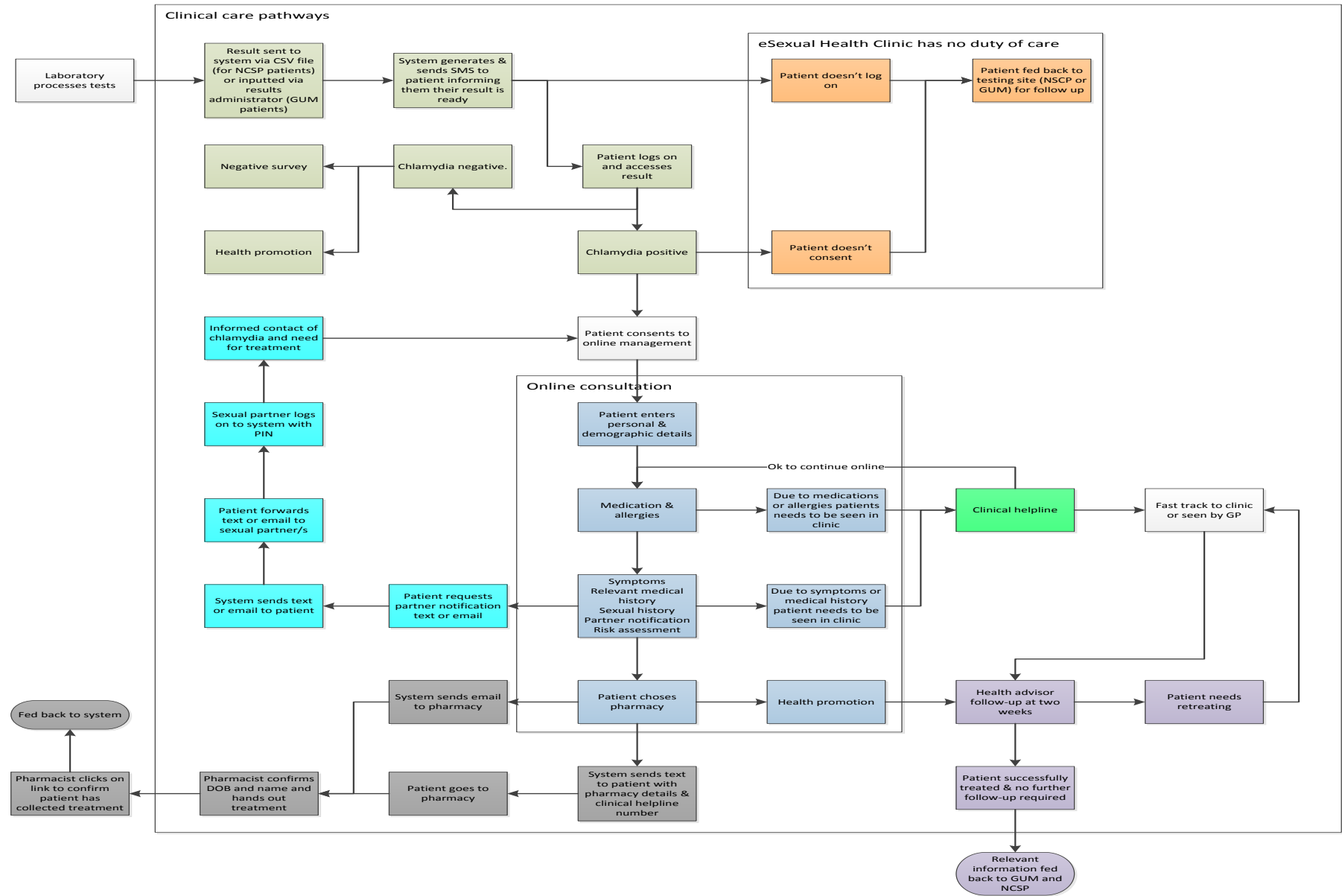


Figure 35: A screenshot of the waiting/in progress follow-up screen



The online clinical consultation, and where it fits within the eSexual Health Clinic and Chlamydia-OCCP, is illustrated in Figure 36 below.

Figure 36: eSexual Health Clinic





STEP 4: EXPERT REVIEW

The draft online clinical consultation was then reviewed by expert clinicians and non-clinicians within the eSTI² consortium with respect to the content, phrasing and flow of questions and text. The expert review panel consisted of consultant genitourinary medicine and public health physicians, academics in sexual health, public health, human computer interaction, bioethics, health economics and a research health adviser. Due to the multidisciplinary and multi-institutional nature of the expert group, this produced a large amount of discussion in terms of the questions being asked, how they were phrased, what to include and what was beyond the scope of this study (e.g. emergency contraception, drug and alcohol history). I therefore circulated the online clinical consultation, asked for individual feedback and then arranged to discuss this at the monthly work stream meeting so that we could come to a consensus. Any issues where we were unable to reach consensus, were specifically looked at as part of the comprehension (step 5) and usability testing (step 6) described below. Examples of questions that generated discussion included:

1. How to ask whether patients had previously had an STI and which STIs to specifically ask about. It was decided that it would be better to ask about specific STIs rather than whether they had a sexual health screen previously. The two STIs that I felt to be of most benefit to ask about were chlamydia (particularly as if they had been diagnosed within the preceding 6 weeks it could be that they were re-testing too soon) and HIV. The panel agreed with this.
2. How to ask patients about sexual partners from outside the UK. Issues raised with this included how to phrase what are countries/areas of higher risk of HIV infection without appearing xenophobic, and not having to rely on people's knowledge of geography in terms of area, along with the best way to structure the question. It was decided that using a free text



box would result in people potentially misspelling countries and would be potentially difficult manually if using a smartphone, and a drop down list of different countries would also not be ideal due to the number of countries in the world. Instead we decided to go with a free text box that used predictive text. Revisions were made before moving on to step 5.

STEP 5: COMPREHENSION TESTING

In order to try and ensure that patients' interpretation and comprehension of the text and questions asked within the online clinical consultation was the same as my own, I decided to conduct cognitive testing. Beatty and Willis define cognitive testing as 'the administration of draft survey questions while collecting additional verbal information about the survey response, which is used to evaluate the quality of the response or to help determine whether the question is generating the information that its author intends'(360).

I conducted cognitive interviews with patients at a GUM Clinic in Bury St Edmunds at an early stage of development to ensure that the initial draft of the questionnaire was comprehensible to users and that their interpretation of the question asked was the same as the researcher's interpretation. I initially tested a print out of the questions with three patients. I asked each patient to read through the questions and text and to tell me what they thought the questions/text meant. I then asked probing questions as necessary. One of the main findings from this was that people either did not know what azithromycin (a macrolide and first-line treatment for chlamydia (361)) was or confused it with erythromycin. This meant that they were unable to accurately interpret and answer the question relating to allergies. It was therefore necessary to develop a series of questions which allowed patients with no allergies to pass on to the next section whilst ensuring that any patients who were allergic to macrolides came off the online pathway and into clinic.



I then conducted two further rounds of testing using three patients for each round. By the third round all three patients were able to understand the questions and text and interpreted them correctly. I conducted further cognitive testing with members of the public using the same technique once the demonstration version of the web app was available in June 2014. At this stage no further amendments were necessary. More in-depth work was conducted on an ad hoc basis where it became apparent that patients were not using or did not understand a section of the pathway. For example, we noticed a couple of months into the study that not many index patients were not requesting the partner notification PIN to pass on to the sexual partners. In addition, even when index patients did request the PIN code, they were either not passing it on to their sexual partners or choosing not to use it. Information as to why this was happening was captured in the quantitative service evaluation which formed part of the health adviser follow-up interview at two weeks (discussed in Chapter 6). As an initial response, I, along with a Senior Researcher and a Human Computer Interface researcher, worked on revising the partner notification page. In addition the senior researcher and I revised the text and email message that was sent to the index patient. I then cognitively tested these with members of the public and we revised the system and messages accordingly.

This revision provided some improvement in the uptake and usage of the PIN for sexual partners. However, the research health adviser still felt that some index patients did not understand how the PIN was to be used and that this had deterred them from requesting and using it. In order to evaluate this further, I amended the quantitative service evaluation (see Chapter 6).



STEP 6: USER CENTRED INTERFACE DESIGN

Initial focus groups were conducted by a Human Computer Interaction researcher in university and secondary schools in order to establish user requirements(181). User interface design principles and guidelines were then used to design the interface to ensure optimal display of questions and response sets, along with facilitating user journey and flow of interaction (362). Lab-based user interface testing was conducted by the Human Computer Interaction researcher with wireframed prototypes. As part of this process comments were made and thoughts expressed about the content of the clinical consultation. Relevant findings have been incorporated into the online clinical consultation and amendments made where necessary.

STEP 7: SPECIFICATION DEVELOPMENT

As part of the iterative process in development of the online clinical consultation, I reviewed the literature and guidelines to ensure that the knowledge base on which the content of the online clinical consultation was based was optimal. Enquiries were made to various professional organisations including the Electronic Prescribing Service, and a number of pharmacies were contacted, with regards to the electronic prescribing component of the consultation.

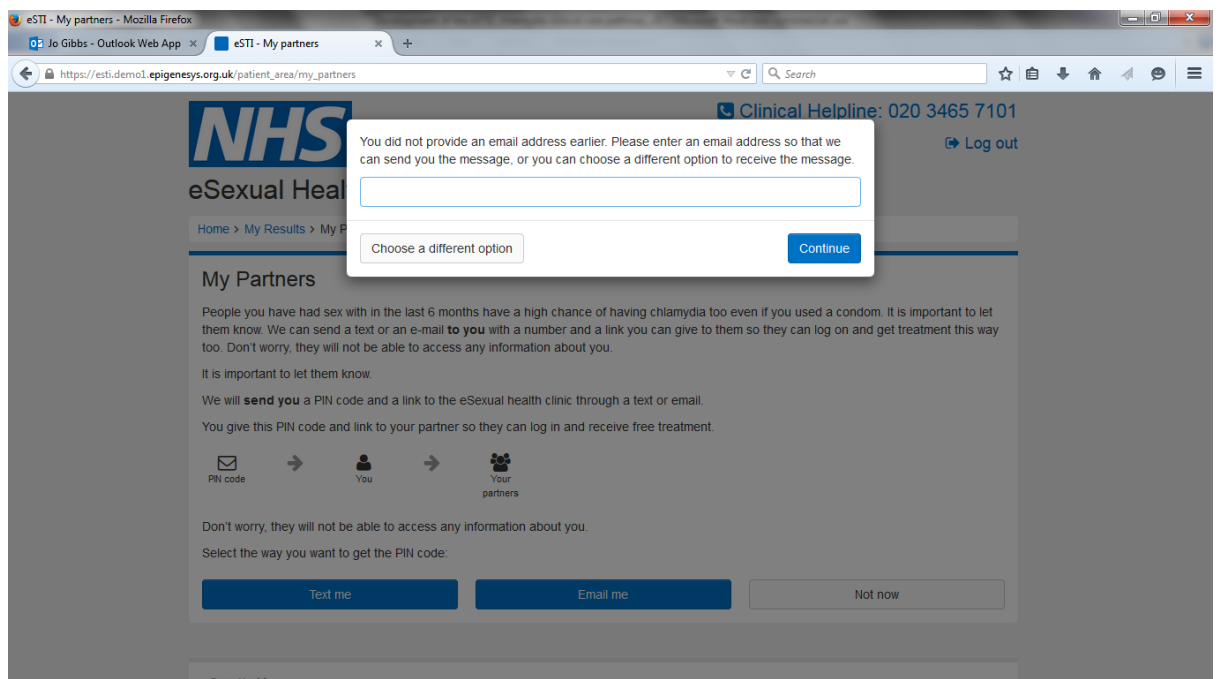
I endeavoured to balance the content and questions with what was mandatory in terms of current best practice guidelines and legislation, with what I considered needed to be included to ensure that the pathway was safe, supportive but feasible for a user to complete. I used skip patterns to facilitate patient flow through the pathway. The consultation was then reviewed again by a select group of expert clinicians and non-clinicians within and out with the eSTI² consortium. Following this, a Senior Researcher and I developed the specification for the



development of the online clinical consultation. As part of this process the pathway and online clinical consultation were revised and amended.

The online clinical consultation was converted into the database specification in order for the software engineers to design the system according to our needs. We took the text, questions and logic and placed it into a spreadsheet, adding data item numbering and field names. We asked that each data item be time stamped and dated. This ensured that the database would capture the necessary information for the electronic health records and for quantitative and economic analysis. During the creation of the specification, I developed messages to pop-up on the screen providing information for the patient when they fell off or choose a certain option (e.g. the PIN for sexual partners). Figure 37 below illustrates an example of this.

Figure 37: Example of a pop-up screen





Other functions that I ensured that the system had included the ability for a health adviser to put a patient back on the system if they had fallen off inappropriately and were assessed as being safe to continue.

As well as developing the ‘front end’ of the system, with the database specification, I also helped develop the ‘back end’, with the software specification. The back end includes the programme manager, results administrator and health adviser interface along with the transfer of data from The Doctors Lab. In addition, it includes the export data sheet which I designed to capture all the data on the system. The codebook I developed, describing the export datasheet, is shown in Table 67 below.

Table 67: Export data sheet codebook

Section	Parameter/Field Name	Description	Coding
Results administrator	Username	Results administrator (RA) email address	User email address
	Date logon	Date RA logged on	DD/MM/YY
	Time logon	Time RA logged on	Time
	Date text message sent	Date system sent text message	DD/MM/YY
	Time text message sent	Time system sent text message	Time
	System identifier	Unique system identifier	Index patients = site code + unique 6 digit PIN number e.g. AKC123456 ; sexual partners (SPs) = index patient's PIN number with additional numeral depending on logon sequence compared to other SPs e.g. AKC123456001
	Site code/SP	Site code index patient originated from or SP for sexual partner.	AKC= Ambrose King Centre; BHC= barts sexual health centre; SGC = St George's Clinic; CLEW= Lewisham; CBEX = Bexley; CBRM= Bromley; CGRE = Greenwich; CLAM = Lambeth; CSWK = Southwark; SP = sexual partner
	Results number	Clinic results number or last 6 digits of NCSP unique number	6 digit
	RESDOB SPDOB	RA entered date of birth	DD/MM/YY
	RESGEM RESGEF	RA entered gender	1= Female 2= Male
	RESDATEST	RA entered date of chlamydia test	DD/MM/YY
	RESPOS RESNEG	RA entered result of chlamydia test	1=positive 2= negative
	Date of log off	Date RA logged off	DD/MM/YY
	Time of log off	Time RA logged off	time
Results service	Date of logon LOGON SPLOGON	Date index patient/SP logged on	DD/MM/YY
	Time of logon LOGON SPLOGON	Time index patient/SP logged on	Time
	LOGON DOB	Date of birth index patient logged on with	DD/MM/YY
	LOGONRSNUM	Results number index patient logged on with	6 digit (except SGC - X+5digits)
	Date every time px accesses results CLICKACCESSTST	Date index patient accesses results	DD/MM/YY
	Time every time px accesses results CLICKACCESSTST	Time index patient accesses results	time
	CLICKACCESSTST	Index patient accesses results	1. Yes 2. No
	Platform used	Platform index patient/SP used to access system	Platform (e.g. android)
	INGUMFPALEAF/INNCSPPFALEAF/SPCLINFO	Index patient/SP accesses FPA leaflet on chlamydia on results page	1 = yes 2= no
	INNCSPPSEXCLINIC	NCSP index patient accesses link on sexual health clinics	1 = yes 2= no
Consent and access of online consultation	INGUMINFO/INNCSPPINFO/SPCLCKINFO	Index patient/SP accesses PIL	1=yes 2=No
	INGUMCONYES INNCSPPCONYES SPCONYES	index patient/SP consents to continue online	1 = ticked 2 = not ticked
	INGUMCONNO INNCSPPCONNO SPCONNO	Index patient/SP does not consent to continue online	1 = ticked 2 = not ticked
	INGUMCONYES/INNCSPPCONYES /SPCONYES	Date of consent	DD/MM/YY
	INGUMCONYES/INNCSPPCONYES /SPCONYES	Time of consent	Time
	Date everytime pt accesses online consultation	Date index patient/SP accesses online consultation	DD/MM/YY
	Time everytime pt accesses online consultation	Time index patient/SP accesses online consultation	Time
	Date every time pt exits consultation	Date index patient/SP exits online consultation (by clicking log off)	DD/MM/YY
	Time every time pt exits on line consultaiton	Time index patient/SP exits online consultation (by clicking log off)	Time
	Data item patient exits on or comes off the system on	Data item index patient/SP exits the system on (by clicking log off)	Data item
	Date pt dropped off	Date index patient/SP drops off the system	DD/MM/YY
	Time pt dropped off	Time index patient/SP drops off the system	Time
	Question pt dropped off	Question index patient/SP drops off the system	Data item
	Completed consultation within 14 days	Index patient/SP completes the consultation with in 14 days of their result being placed on the system	1=Yes 2=No
HA notes	Consultation notes	Notes from clinical helpline phone calls & HA follow-ups	Text

Section	Parameter/Field Name	Description	Coding
My details	AGE	Index patient/SP entered age	Numerical
	ETHNIC SPETHNIC	Index patient/SP entered ethnicity	ONS code (as provided)
	POSTCD	Index patient/SP entered postcode (first 4 digits only)	First 4 digits of postcode
	GENDER SPGENDER	Index patient/SP entered gender	1=female 2=male
My medications and allergies	REGMEDS	Index patient/SP on regular medications	1= yes 2=No
	DRUGINTER	Index patient/SP taking one of the following: Ciprofloxacin (Ciproxin), Citalopram (cipramil) , Warfarin, Ergotamine (Migril), Bromocriptine (Parlodel), Cabergoline (Dostinex), Ciclosporin (Deximune, Neoral), Droperidol (Xomolix), Mizolastine (Mizollen), Pimozide (Orap), Reboxetine (Edronax), Artemether with Lumefantrine (Riamet), Piperaquine with Artesimol (Eurartesim), Theophylline (Nuelin SA, Slo-Phyllin, Uniphyllin Continus)	1 = Yes 2 = No
	CARDARRY	Index patient/SP reported history of cardiac arrhythmias or on medication for their heart	1 = Yes 2 = No
	ALLMED	Index patient/SP allergic to any medications	1 = Yes 2 = No
	ALZITH	Index patient/SP allergic to azithromycin	1 = Yes 2 = No 3= Don't know
	ALGYSYM_1	Index patient/SP gets itch rash, throat or facial swelling or difficult breathing with macrolide antibiotics	1=ticked 2=not ticked
	ALGYSYM_2	Index patient/SP gets nausea, vomiting or diarrhoea with macrolide antibiotics	1=ticked 2=not ticked
	ALGYSYM_3	Index patient/SP gets another reaction with macrolide antibiotics	1=ticked 2=not ticked
	ALGYSYM_4	Index patient/SP has none of these symptoms/reactions with macrolide antibiotics	1=ticked 2=not ticked
	ALSOYPNT	Index patient/SP allergic to soya or peanut	1= yes 2=no
My sexual health	MYASGRAV	Index patient/SP has Myasthenia gravis or severe liver or kidney problems	1= yes 2= no
	FPRECHL MPREVCHL	Index patient/SP has previously had chlamydia	1 = Yes 2 = No
	TIMEPVCHL MTIMEPVCHL	When was index patient/SP previously diagnosed with chlamydia	1 = 0-6 weeks 2 = 6weeks -6/12 3= 7-12 to12months 4 = > 1yr
	PREHIV MPREHIV	Index patient/SP previously been tested for HIV	1 = Yes 2 = No 3= Don't know
	HIVTEST MHIVTEST	Last time index patient/SP was tested for HIV	1 = within the last 6months 2 = 6-12 months ago 3 = >1yr
	PREHIVRST MPREHIVTEST	Result of HIV test	1 = Negative 2 = positive 3 = don't know
	SEXPART MSEXPART	Number of sex partners in the last 6 months (<i>index patient only</i>)	Numerical
	PNREQUEST MPNREQUEST	Method index patient wants to get the PN PIN number (<i>index patient only</i>)	1=Text 2=Email 3=Not now
	NEWSXPART MNEWSXPART	Number of new sex partners in the last 6 months (<i>index patient only</i>)	Numerical
	GENDERSXPART MGENDERSXPART	Gender of sex partners in the last 6 months (<i>index patient only</i>)	1=women only 2 = men 3 = both men & women
	INJDRUG MINJDRUG	Ever injected drugs or had sex with someone who has injected drugs	1 = yes 2 = no
	PAIDSX MPAIDSX	Ever received or payed money for sex	1 = yes 2= no
	SXCOUNTRY MSXCOUNTRY	Ever had sex with someone from outside the UK or Ireland?	1 = yes 2= no
	SXCOUNTRY_1 MSXCOUNTRY_1	List of countries that index patient/SP's sexual partners originate from	List of countries
	HEPB MHEPB	Ever been vaccinated for Hepatitis B	1 = yes 2 = no 3 = don't know
Pharmacy	PHRMNOM	Name of pharmacy that index patient/SP has chosen	Name of patient chosen pharmacy
	PHRMNOM Date	Date that pharmacy was chosen (i.e. finished consultation)	DD/MM/YY
	PHRMNOM Time	Time that pharmacy was chosen (i.e. finished consultation)	time
	VERBPHARM	Verbal authorisation for pharmacist to give out treatment by HA	1=yes 2=No
	DATVERBPHARM	Date verbal authorisation given by HA	DD/MM/YY
	DATVERBPHARM	Time verbal authorisation given	time
	VERBPHARMBY	HA who gave verbal authorisation	Text
	DATPHARM	Date that link is clicked in pharmacy email to say that patient has collected treatment	DD/MM/YY
	DATPHARM	Time link is clicked in pharmacy email to say that patient has collected treatment	time
	PACKDIS	Antibiotics dispensed	1 =Yes 2=no

Section	Parameter/Field Name	Description	Coding
HCI Usability questionnaire	USABSTARTDAT	Date Index/SP accessed usability survey	DD/MM/YY
	USABSTARTDAT	Date Index/SP completed usability survey	DD/MM/YY
	USABFINDAT	Time started survey	Time
	USABFINDAT	Time completed survey	Time
	USABQ1	I felt I received a high quality service through the esexual health clinic	1=strongly disagree, 2=disagree,3=neither agree or disagree,4=agree,5 strongly agree,6=NA
	USABQ2	The appearance of the esexual health clinic was professional	1=strongly disagree, 2=disagree,3=neither agree or disagree,4=agree,5 strongly agree,6=NA
	USABQ3	The esexual health clinc was easy to use	1=strongly disagree, 2=disagree,3=neither agree or disagree,4=agree,5 strongly agree,6=NA
	USABQ4	It is easy to lose track of where you are in the esexual health clinic consultation	1=strongly disagree, 2=disagree,3=neither agree or disagree,4=agree,5 strongly agree,6=NA
	USABQ5	Recovering from mistakes in the esexual health clinc was quick and easy	1=strongly disagree, 2=disagree,3=neither agree or disagree,4=agree,5 strongly agree,6=NA
	USABQ6	It wasn't always clear what information I should enter within the esexual health clinic consultation	1=strongly disagree, 2=disagree,3=neither agree or disagree,4=agree,5 strongly agree,6=NA
Health promotion	USABQ7	It was clear how I could get help offline when using the esexual health clinic	1=strongly disagree, 2=disagree,3=neither agree or disagree,4=agree,5 strongly agree,6=NA
	USABQ8	Overall I am satisfied with my experience of using the esexual health clinic	1=strongly disagree, 2=disagree,3=neither agree or disagree,4=agree,5 strongly agree,6=NA
	INHEALTHPRO	Clicked to access health promotion on negative page (<i>negative only</i>)	1 = clicked 2 = not clicked
	NEGINFOCHLAM	Clicked link 'Find out more about chlamydia' (<i>positive & negative</i>)	1 = external link clicked 2 = external link not clicked
	NEGINFOINFEC	Clicked link 'Get checked for other infections' (<i>positive & negative</i>)	1 = external link clicked 2 = external link not clicked
	NEGSFAF	Clicked link 'How to keep yourself safe' (<i>positive & negative</i>)	1 = external link clicked 2 = external link not clicked
Negative quantitative survey	NEGCONT	Clicked link 'Contraception' (<i>positive & negative</i>)	1 = external link clicked 2 = external link not clicked
	NEGABUS	Clicked link 'Had sex against your will or in an abusive relationship' (<i>positive & negative</i>)	1 = external link clicked 2 = external link not clicked
	TICKNEGSURVEY	Agree to answer short survey (<i>negative only</i>)	1 = clicked 2 = not clicked
	NEGSRTST	Was this the first time you have been tested for chlamydia? (<i>negative only</i>)	1 = yes 2 = no
	NEGSRPVRES_1	Previously got test results via text message (<i>negative only</i>)	1= ticked 2 = not ticked
	NEGSRPVRES_2	Previously got test results via phone call (<i>negative only</i>)	1= ticked 2 = not ticked
	NEGSRPVRES_3	Previously got test results via letter (<i>negative only</i>)	1= ticked 2 = not ticked
	NEGSRPVRES_4	Previously got test results via email (<i>negative only</i>)	1= ticked 2 = not ticked
	NEGSRPVRES_5	Previously got test results via other method (<i>negative only</i>)	1= ticked 2 = not ticked
	NEGSRCOMPARE	Thought the way they got result this time was (<i>negative only</i>)	1 = Much better 2 = better 3 = About the same 4 = worse 5 = much worse
	NEGSRFUT	Would you be happy to get your results this way in the future (<i>negative only</i>)	1 = yes 2 = no
	NEGSRCOM	If you have any comments please write them in this box (<i>negative only</i>)	Text
	NEGSRRSTXT	Were you happy with the way you were given your results? (<i>negative only</i>)	1 = yes 2 = no
	NEGSRFUTRST	If your test showed you had chlamydia in the future, would you be happy to get your results this way if your test was positive (<i>negative only</i>)	1 = yes 2 = no
	NEGSRPREF_1	Rather have got result via an email with a link to access results instead of text (<i>negative only</i>)	1 = yes 2 = no
	NEGSRPREF_2	Rather have had a text saying 'the result of your chlamydia test is negative/positive. You do not/do have chlamydia' (<i>negative only</i>)	1 = yes 2 = no
	NEGSRPREF_3	Rather have had an email saying 'the result of your chlamydia test is negative/positive. You do not/do have chlamydia' (<i>negative only</i>)	1 = yes 2 = no
	NEGSRPREF_4	Rather have had result via another way (<i>negative only</i>)	1 = yes 2 = no
	NEGSRPREF_5	Way he/she would have preferred to get their result (<i>negative only</i>)	Text
	NEGSRCOMENT	Other way px would have preferred to get result (<i>only patients who have ticked NEGSRPREF_4</i>)	Text

Section	Parameter/Field Name	Description	Coding
HA: details of follow-up	Date logged on	Date health adviser (HA) logged on	DD/MM/YY
	Time logged on	Time HA logged on	Time
	Date logged off	Date HA logged off	DD/MM/YY
	Time logged off	Time HA logged off	Time
	Date follow-up started	Date HA started follow-up	DD/MM/YY
	Time follow-up started	Time HA started follow-up	Time
	Date clinical follow-up finished	Date HA finished clinical follow-up (i.e. answered DISCUSSION SPFREETEXT)	DD/MM/YY
	Time clinical follow-up finished	Time HA finished clinical follow-up (i.e. answered DISCUSSION SPFREETEXT)	Time
	Date follow-up finished	Date HA finished follow-up (i.e. answered QUALINT or PERMFURESEA)	DD/MM/YY
	Time follow-up finished	Time HA finished follow-up (i.e. answered QUALINT or PERMFURESEA)	Time
	Name of HA doing follow-up	Name of HA doing follow-up	Name
	Follow-up completed	Completed follow-up	1= Yes 2=No
	IDATEFU SPDATEFU	Date of each separate followup call for a given followup.	DD/MM/YY
	IDATEFU SPDATEFU	Time of each separate followup call for a given followup.	Time
HA: follow-up treatment section	INEXTREATED SPTREATED	Index patient/SP treated	1 Yes 2 No
	IWHENTREAT SPWHENTREAT	When index patient/SP treated	1 = Same day as received result 2 = 1 day after receiving result 3 = 2 days after receiving result 4 = 3 days after receiving result 5 = 4 days after receiving result 6 = 5 days after receiving results 7 = 6 days after receiving results 8 = 7 days after receiving results 9 = >1/52 after receiving results
	IWHEREETREAT SPWHEREETREAT	Where index patient/SP treated	1 = Via online clinical consultation at chosen pharmacy 2 = in a sexual health clinic 3 = at GPs 4 = at pharmacy 5 = Family planning clinic/CASH 6 = Other - free text
	IWHEREETREAT_6 SPWHEREETREAT_6	Where index patient/SP treated	Text
	IVOMIT SPVOMIT	Vomited within 2 hours of taking Azithromycin	1 = yes 2 = no
	IRETREAT SPRETREAT	Has patient been retreated	1 = yes 2 = no
	ISIDEF SPSEFFECT	Any other problems/side-effects with treatment	1 = Yes 2 = no
	ISIDEF_1 SPDESSEFFEC	Nature of problem/side-effect	Text
	IINTERCOUR SPINTERCOUR	Any sexual intercourse within 1 week of treatment	1 = yes 2 = no
	INTERUNTPT SPINTUNTREAT	Any sexual intercourse with untreated/inadequately treated partner	1 = yes 2 = no
	IWHEREETREAT SPRETREAT	When will they go for retreatment and where	Free text
	FURFUREQ	Further follow-up required	1 = yes 2 = no
	SPMETHPN	Method contact notified by index	1 = Face to face 2 = By phone 3 = Txt only 4 = Email only 5 = Face to face & text 6 = Face to face & email 7 = By phone & text 8 = text & email 9 = facebook 10 = other - free text
	SPMETHPN_10	Other method used by index to contact index	Text
	IHEALTHPROM SPDISCUSS	Discussion around any symptoms ticked on online consultation (only if symptoms ticked on online consultation)	(data item 4a) free text box
	ISYMRESOLVED SPSYMRESOLVE	Symptoms resolved (only if symptoms ticked on online consultation)	1 = yes 2 = no 3 = some improvement but still present
	IADVICE SPADVICE	Did index patient/SP seek advice on their symptoms (only if symptoms ticked on online consultation)	1=yes 2 -no
	IWHEREADVI SPADVWHERE	Where index patient/SP sought advice on their symptoms (only if ticked yes to IADVICE SPADVICE)	1 = sexual health clinic 2 = GP 3 = 111 telephone service 4 = clinical helpline 5 = other - free text
	IWHEREADVI_5 SPADVWHERE_5	Where index patient/SP sought advice on their symptoms - other (only if ticked yes to IADVICE SPADVICE)	Text
HA: Partner notification PIN section	IANYADVI SPANYADVICE	Other information gathered/advice given (only if ticked yes to IADVICE SPADVICE)	Text
	IDISCUSSHIV SPDISCUSSHIV	Discussion about risk factors HIV/STIs/Hep B testing (only if ticked yes to MSMPART, INJDRUG, PAIDSX, SXCOUNTRY, HEPB)	Text
	INOPARTNER	Number of sex partners in the last 6 months (index patient only; populated from SEXPART MSEXPART)	Numerical
	PINGIVEN	Did index given PIN & link to online clinical consultation to partner/s	1=yes 2=no 3=Dropped off consultation before PN section 4. Chose not to receive PIN & link
	PINUNDERSTAND	(If yes to PINGIVEN) Did index patient understand how the PIN & link was to be used	1=yes 2=no
	PINUNDERSTANDDET	If no to PINUNDERSTAND, free text box	Text
	REASONPINNOT	If no to PINGIVEN, reason why PIN and link not given to partner/s	1. Deleted text/email prior to informing partner; 2. Too embarrassed; 3. partner not interested in online method; 4. Forgot to forward text; 5. Forgot to forward email; 6. Didn't understand what PIN and link were for; 7. Other
	REASONPINNOTOTH	If 7 to REASONPINNOT, free text box	Text
	REASONPINNOTGET	If 4 to PINGIVEN, reason why index decided not to get PIN & link	1. Didn't understand how it would work; 2. Preferred to let partner/s know by other method; 3. Other
	REASONPINNOTGETOTH	If 3 to REASONPINNOTGET, free text box	Text

Section	Parameter/Field Name	Description	Coding
Service evaluation/quantitative questionnaire	TEXTOK_1	Index happy with result text message	1. Ticked 2. Not ticked
	TEXTOK_2	Index would have preferred an email	1. Ticked 2. Not ticked
	TEXTOK_3	Index would have preferred the text message told them their result	1. Ticked 2. Not ticked
	TEXTOK_4	Text message wasn't clear (<i>index patient only</i>)	1. Ticked 2. Not ticked
	TEXTOK_5	Other reason index wasn't happy with text message	Free text
	PARTNER_TEXTOK_1	SP happy with the message he/she received informing him/her that he/she could access treatment online?	1. Ticked 2. Not ticked
	PARTNER_TEXTOK_2	SP felt that the text message wasn't clear	1. Ticked 2. Not ticked
	PARTNER_TEXTOK_3	SP felt that the text message was too blunt	1. Ticked 2. Not ticked
	PARTNER_TEXTOK_4	Other reason SP wasn't happy with text message	Free text
	PARTNER_TEXTOK_5	Not applicable	1. Ticked 2. Not ticked
	RESINFOAMT	When you accessed your results, did you think the amount of information you were given was	1. Not enough 2. About right 3. too much 4. not applicable
	EASYOCC	How easy did you find the questions in the online clinic to complete?	1. Very Easy 2. Easy 3. Neither easy nor difficult 4. Difficult to understand 5. Very difficult to understand 6. Not applicable
	COMFORTOCC	How comfortable did index/SP feel answering questions	1. Very comfortable 2. Comfortable 3. Neither Comfortable nor uncomfortable 4. Uncomfortable 5. Very uncomfortable 6. Not applicable
	COMFOCCFTF	How comfortable index/SP was answering questions compared to answering face-to-face with a doctor or nurse	1. Much more comfortable online compared to face-to-face 2. more comfortable online compared to face-to-face 3. About the same 4. Less comfortable online compared to face-to-face 5. Much less comfortable online compared to face-to-face 6. Not applicable
	INFOOCCAMT	Index/SP thought that the amount of information given in the online clinic was	1. Not enough 2. About right 3. too much 4. not applicable
	INFOOCCOK	Index/SP felt that this information was	1. Very easy to understand 2. Easy to understand 3. Neither easy nor difficult to understand 4. Difficult to understand 5. Very difficult to understand 6. Not applicable
	FREETXTOK	Any other comments spontaneously made by index/SP	Free text
	CLINHELP	Did index/SP use clinical helpline	1. Yes 2. No
	HELPPFUL	Did index/SP find clinical helpline helpful	1. Yes 2. No 3. Unable to remember
	NOTHELPPFUL	Why index/SP did not find clinical helpline helpful	1. Opening hours to restrictive 2. Unable to answer question/query 3. Other reason
	NOTHELPPFUL_3	Other reason why index/SP did not find clinical helpline helpful	Free text
	PREVCHLAM	Has index/SP had chlamydia before this episode	1. Yes 2. No
	OCCOMPARERES	How did the online results system compare to the last experience of getting results (<i>index patient only</i>)	1. Much better 2. Better 3. About the same 4. Worse 5. Much worse
	METHAGAIN	Would index patient use this method of accessing their results again? (<i>index patient only</i>)	1. Yes 2. No 3. Unsure
	OCCOMPARETREAT	How did using the online clinic to get antibiotic treatment compare to your last experience of getting antibiotics (<i>index patient & SP</i>)	1. Much better 2. Better 3. About the same 4. Worse 5. Much worse 6. Not applicable
	ACCESSAGAIN	Would you use this method of accessing your antibiotic treatment again? (<i>index patient & SP</i>)	1. Yes 2. No 3. Unsure
	HOWACCOCC_1	Accessed online clinic using mobile phone	1. Ticked 2 Not ticked
	HOWACCOCC_2	Accessed online clinic using desktop computer	1. Ticked 2 Not ticked
	HOWACCOCC_3	Accessed online clinic using laptop	1. Ticked 2 Not ticked
	HOWACCOCC_4	Accessed online clinic using tablet/ipad	1. Ticked 2 Not ticked
	HOWACCOCC_5	Accessed online clinic using other combination	1. Ticked 2 Not ticked
	HOWACCOCC_5_TEXT	Other combination used to accesse online clinic	Free text
	PREFACE	Would you rather have had a face-to-face consultation with a doctor or nurse	1. Yes 2. No 3. Unsure
	PREFACE_1	Any comments on why index patient/SP would rather had a face-to-face consultation	Free text
	PROBPHARM	Any problems getting treatment from pharmacy	1. Yes 2. No 3. Not applicable
	PROPPHARM_1	Description of problems with pharmacy	Free text
	RECOMMEND	Would index patient/SP recommend the online clinic to friends?	1. Yes 2. No 3. Unsure
	RATECARE	Overall, how would you rate the care you received via the online clinic	1. Excellent; 2. Very good; 3. Good; 4. Fair; 5. Poor; 6. Very poor

Section	Parameter/Field Name	Description	Coding
Questions that were amended or removed during the study as part of iterative development	OLD_EASYOCC	How easy did you find the questions in the online clinic to complete?	1. Very Easy 2. Easy 3. Neither easy nor difficult 4. Difficult to understand 5. Very difficult to understand
	OLD_COMFORTOCC	How comfortable did you feel answering these questions online	1. Very comfortable 2. Comfortable 3. Neither Comfortable nor uncomfortable 4. Uncomfortable 5. Very uncomfortable
	OLD_INFOOCCAMT	Did you think the amount of information you were given throughout the online consultation was	1. Not enough 2. About right 3. too much
	OLD_INFOOCCUND	Did you thin the information you were given throughout the online consultation was	1. Very easy to understand 2. Easy to understand 3. Neither easy nor difficult to understand 4. Difficult to understand 5. Very difficult to understand
	OLD_FREETXTOCC	Any other comments spontaneously made by index patient on results service or online consultation	Free text
	OLD_TEXTOK_1	Thought the text message was okay	1 = ticked 2 = not ticked
	OLD_TEXTOK_2	Index patient would have preferred to have an email	1 = ticked 2 = not ticked
	OLD_TEXTOK_3	Index patient would have preferred a text which told him/her the result	1 = ticked 2 = not ticked
	OLD_TEXTOK_4	Text message wasn't clear (index patient only)	1 = ticked 2 = not ticked
	OLD_TEXTOK_5	Other reason text message wasn't clear (index patient only)	Free text
	OLD_PARTNER_TEXTOK_1	SP happy with the message he/she received informing him/her that he/she could access treatment online?	1. Ticked 2. Not ticked
	OLD_PARTNER_TEXTOK_2	SP felt that the text message wasn't clear	1. Ticked 2. Not ticked
	OLD_PARTNER_TEXTOK_3	SP felt that the text message was too blunt	1. Ticked 2. Not ticked
	OLD_PARTNER_TEXTOK_4	Other reason SP wasn't happy with text message	1. Ticked 2. Not ticked
	OLD_PARTNER_TEXTOK_5	Other reason SP wasn't happy with text message	Free text
	OLD_CLINHELP	Did index/SP use clinical helpline	1. Yes 2. No
	OLD_HELPFUL	Did index/SP find clinical helpline helpful	1. Yes 2. No 3. Unable to remember
	OLD_NOTHELPFUL	Reason index/SP didn't find clinical helpline helpful	1. Opening hours to restrictive 2. Unable to answer question/query 3. Other reason
	OLD_NOTHELPFUL_3	Other reason index/SP didn't find clinical helpline helpful	Free text
	OLD_PREVCHLAM	Has index/SP had chlamydia before this episode	1. Yes 2. No
	OLD_OCCOMPARERES	How did using online clinical consultation compare to last experience of getting results (index patient only)	1. Much better 2. Better 3. About the same 4. Worse 5. Much worse
	OLD_METHAGAIN	Would index patient use this method of accessing their results again (index patient only)	1. Yes 2.No 3. Unsure
	OLD_OCCOMPARETREAT	How did using online clinical consultation compared to index patients's last experience of getting treatment (index patient only)	1. Much better 2.Better 3.About the same 4. Worse 5. Much worse
	OLD_ACCESSAGAIN	Would index/SP use this method of accessing treatment again?	1. Yes 2. No 3. Unsure
	OLD_HOWACCOCC	How did index/SP access the online consultation?	1. Mobile phone 2.Desktop computer/Laptop 3. Tablet/ipad 4. Combination
	OLD_HOWACCOCC_4	Combination used to access online consultation	Free text
	OLD_PREFACE	Would index px/SP have preferred to have a face-to-face consultation with a doctor/nurse than use the online clinical consultation?	1. Yes 2. No 3. Unsure
	OLD_PREFACEDETAILS	Why index px/SP would have preferred to have a face-to-face consultation than use the online clinical consultation	Free text
	OLD_PROBPHARM	Did index patient/SP have any problems getting treatment at the pharmacy?	1. Yes 2. No 3. Not applicable
	OLD_PROPPHARM_1	What problem/s did index patient/SP have at pharmacy	Free text
	OLD_RECOMMEND	Would index patient/SP recommend the eSexual Health Clinic to friends?	1. Yes 2. No 3. Unsure
	OLD_RESINFOOK	Do you think this information was	1. Very easy to understand 2. Easy to understand 3. Neither easy nor difficult to understand 4. Difficult to understand 5. Very difficult to understand 6. Not applicable

The human computer interface researcher then converted the specification into a wireframe (a screen blueprint) to illustrate how we wanted the interface to look. The senior researcher and I were closely involved in the development of this, providing detailed feedback to ensure that the wireframe reflected the specification and our needs. During this time I assisted the senior researcher with the development of the software specification. The software



specification included a description of the accessibility testing that we required the software engineers to undertake prior to deployment of the live system.

Once we were happy with the wireframes and specifications, these were sent to the software engineers who developed a demonstration system for us to test. The human computer interface testing and further comprehension testing is described in Step 8 below. However, the senior researcher and I also needed to check that the screens were accurate, that the correct messages came up, that the logic was correct and that it was coding correctly. This was an iterative process which involved close communication with the software engineers.

STEP 8: USABILITY TESTING AND FURTHER COMPREHENSION

TESTING

A high fidelity mobile application was developed from the finalised online clinical consultation by the human computer interface researcher. This was evaluated by laboratory-based usability testing with volunteers from Brunel University. Users were asked to work their way through the mobile application, without prompting, and to express their thoughts, questions and ideas aloud. The human computer interface researcher then fed back her findings and both the senior researcher and I made necessary amendments to the online clinical consultation.

STEP 9: PILOTING OF THE ONLINE CLINICAL CARE PATHWAY

The online clinical care pathway was piloted between 21st July 2014 to 13th March 2015 in an exploratory study of patients diagnosed with chlamydia in both a clinical and non-clinical



(internet-requested testing via the NCSP) setting. Once the live system deployed, continued development of the front end and back end was required as different issues, which had not been foreseen, arose. Examples of these issues and the solutions I came up with are listed in Table 68 below.

Table 68: Examples of issues that arose during the exploratory study.

Issue	Solution
Health adviser interface not fit for purpose	I worked closely with the research health adviser to make the necessary changes. This was an iterative process that continued for the majority of the study. The research health adviser supplemented the interface with additional excel spreadsheets. These will be incorporated into the back-end as part of any future trial.
Two NCSP sites started dual testing for gonorrhoea, which meant that 5 out of 6 sites were now providing dual testing	I changed the results page so that patients received accurate information on the results of their test; this required different results pages depending on whether the patient had tested in a GUM clinic or NCSP site, and which NCSP site they had tested at.
When St George's GUM clinic came on board it became apparent that they had a 7 digit results number which they would not be able to log in with	I arranged for St George's patients to log in using the same method as the NCSP patients – i.e. with their mobile number and date of birth
Pharmacists were having issues with not being able to log in to their nhs.net account to retrieve the authorisation email	I suggested that the research health adviser provide verbal authorisation so that the patient could be given the treatment. In order for this to be recorded on our system, I asked the software engineers to add a tab on the health adviser screen that they could press if they verbally authorised treatment.
Some patients coming off the pathway wanted to attend their GP or a non-study clinic	I developed a letter that the HA could email to the patient which they could give to their GP or to the HCP in clinic.

Every time that we changed anything with the system I updated the specification and export datasheet, and checked that the coding for the changes were correct on the demo system before it was deployed to the live system.

The Chlamydia-OCCP study will be evaluated using quantitative and qualitative methods which are discussed in Chapter 6.

Chapter 6: Development of methods to determine whether the eSTI² Chlamydia online clinical care pathway is feasible, acceptable and safe, throughout an exploratory clinical study

This chapter is composed of the following sections:

1. Introduction
2. Literature review
3. Proposed evaluation methods
4. Quantitative evaluation tools
5. Summary of patient involvement
6. Discussion

1. INTRODUCTION

As previously described, the eSTI² chlamydia online clinical care pathway pilot study is a proof of concept, exploratory study designed to evaluate the feasibility, safety and efficacy of a novel online care pathway for people testing for chlamydia and people who are found to have a positive chlamydia test result. It comprises an online results service, clinical consultation, partner notification and antibiotic authorisation to community pharmacies. It is a highly innovative model of care within the current NHS and offers the possibility for an entirely remote patient journey which involves diagnosis of a new condition and its subsequent

management, including remote prescribing for a person not previously known to the responsible clinician. Although this has the potential to increase access to care, integrate care between different services, and facilitate patients to access appropriate management in an efficient manner, there is also the risk of harm (363;364). Thorough evaluation of the care pathway is therefore of paramount importance (363-365). The pathway is multi-faceted and evaluation must address each subunit of the pathway as far as is feasible(314).

The design and evaluation of eHealth interventions, which are by their nature complex interventions(366), are multifarious and often expensive(367). It is therefore important that new eHealth intervention's benefits outweigh any harm for patient-important outcomes (367;368). With the exception of some high quality behavioural interventions, both within sexual health and HIV (190;369-372) and in other specialities (190;366;373;373-378), many of the eHealth methods / interventions used within healthcare today have been introduced without robust evaluation and lack an evidence base to support their implementation and use (5;39). Atienza et al acknowledge that 'research and evaluation methodologies have not kept pace with the rapid evolution and proliferation of health information and communication technologies'(379).

Currently there is a dearth of appropriate fit-for-purpose standards and guidelines for development of online clinical care pathways and e-Health interventions (379;380), and there is no mode of accreditation. Although CONSORT-EHEALTH standards exist, they have been developed for online randomised controlled trials and are more applicable to behavioural interventions than clinical care pathways (366).

The Chlamydia-OCCP has been developed in line with the Medical Research Council developing and evaluating complex interventions guidance(381). The second phase of the development-evaluation-implementation process that the MRC guidance describes is the piloting and feasibility testing of the intervention. The guidance advises that the questions that need to be asked in this phase are: 'Have you done enough piloting and feasibility work to be confident

that the intervention can be delivered as intended? Can you make safe assumptions about effect sizes and variability and rates of recruitment and retention in the main evaluation study?’(381). The sample size required to make assumptions about the second question was calculated by a statistician as part of the development of the protocol for the exploratory study.

In this chapter, I describe how, using available evidence and guidance, I developed new methods to establish whether the Chlamydia-OCCP is feasible, acceptable and safe. This evaluative methodology was a major component of my doctoral studies. Cost-effectiveness is clearly an important factor in terms of the feasibility of the Chlamydia-OCCP. A cost-consequence analysis is being performed by another eSTI2 PhD researcher and discussion of this is beyond the scope of my PhD.

2. LITERATURE REVIEW

A literature review failed to find any specific online guidance so I conducted a further search of the evaluation and validation of “traditional” clinical care pathways aiming to retain a focus on online or remote pathways as far as feasible. I conducted this using the same methods described in Chapter 2. Initially I searched the literature for evaluation and validation of clinical care pathways Only limited applicable literature was found using this strategy as, although there are some core principles of pathway development (e.g. incorporation of guidelines, and involvement of users at key stages) that need to be incorporated irrespective of whether the pathway is in a traditional clinical setting or online and therefore remote, online pathways are eHealth interventions and therefore are complex interventions which require a completely different approach as discussed below. Therefore, I applied the same search strategy to each individual component of the pathway along with evaluation of eHealth interventions (see Appendix II).

Protocol driven search

I conducted an electronic search of MEDLINE, EMBASE, and The Cochrane Library using the NHS Evidence database thesaurus terms in Table 69:

Table 69: NHS Evidence database thesaurus terms for review of literature on online clinical consultation

Ambulatory care/methods	Health informatics
Critical pathway	Interview as topic
Clinical protocol	Medical history taking
Computer	Online systems
Contact tracing	Program evaluation
Data collection	Remote consultation
Decision making	Reproducibility of results
Decision support systems, clinical	Sexually transmitted diseases/diagnosis
Electronic prescribing	Telemedicine
Evaluation studies as topic	Validation studies as topics

Appendix II shows the search strategy conducted using the above NHS Evidence thesaurus terms and free text. I searched official Government, NHS and Professional Association websites, including existing professional guidance. I then searched Google and Google Scholar to capture both medical and grey literature that had been missed in the above searches. I used both reference and citation tracking to widen the scope of relevant, high quality, sources found.

I was unable to find any suitable methods describing techniques, protocols or methods that could be directly applied to evaluate and validate the type of online care pathway we have developed. However, there was both medical and grey literature that covered evaluation of eHealth interventions. I will discuss this in turn below.

Mainstream literature

The medical literature is divided into articles on clinical care pathways and articles on eHealth and complex interventions, with very little cross-over between the two. I found that the former held little information of relevance to the type of clinical care pathway that we have developed, i.e. an online STI pathway taking someone from a new diagnosis through to treatment, remote from traditional care. I have therefore focussed on the eHealth and complex intervention literature, which mainly contains articles from the UK and USA. These are summarised in Table 70 below.

Table 70: Relevant literature on eHealth evaluation

Ref	First author	Year published	Country	Source focus	Source type	Findings and recommendations
1	Talmon(382)	1999	Netherlands, Spain, Germany, Finland, France	The VATAM guidelines	Review	'Describes the background of the VATAM project and provides an account of the current state of the guidelines'(382)
2	Ammenwerth (363)	2003	Austria and Germany	Evaluation of health information systems – problems and challenges	Research article	Defines the key problem areas with evaluation of health information technology and recommends the development of an evaluation framework
	Ammenwerth(383)	2004	Austria, Denmark, Finland, Germany, UK, The Netherlands	Visions and strategies to improve evaluation of health information systems	Reflections and lessons based on the HIS-EVAL workshop in Innsbruck	Describes typical evaluation questions, problems and barriers to evaluation. Summarises previous work addressing these issues. Suggests visions and strategies for the future and implementation activities.
3	Gustafson (384)	2004	UK	Evaluation of ehealth systems and services	Editorial	Discusses the need to evaluate users needs, the risks/benefits of the intervention/product, feasibility, usability, cultural sensitivities, acceptability and cost effectiveness.
4	Dansky(385)	2006	USA	A framework for evaluating eHealth research	Framework based on two examples	Describe four key, integrated, aspects of eHealth evaluation: 1. Design and methodology issues; 2. Challenges related to the technology itself; 3. Environmental issues that are not specific to eHealth but pose special problems for eHealth researchers; 4. Logistic or administrative concerns of the evaluation methodology.
5	May(386)	2006	UK	A rational model for assessing and evaluating complex interventions in health care	Research article	Examine how complex interventions can become integrated into traditional clinical and organisational practice. Suggest the need to concurrently examine an intervention's: workability; ability to be integrated; professional practice. Article proposes the normalization process model to facilitate this.

Table 70 continued

Ref	First author	Year published	Country	Source focus	Source type	Findings and recommendations
6	Yusof(387)	2008	Malaysia UK	Investigating evaluation frameworks for health information systems	Review	Review of evaluation frameworks in health informatics and information systems. Many evaluation studies either adopt a human and organizational issues approach or take a subjectivist approach. A more comprehensive and specific evaluation framework would be useful.
7	Turner(388)	2008	UK	An evaluation of the accuracy and safety of NHS pathways	Report	In appendices, discusses methods used to evaluate the accuracy and safety of pathways. This includes both internal and external clinical review, electronic pathways review tool, 'bench testing', feedback from users on content, user/site feedback on usability, scenario testing, piloting, and amendment process
8	Catwell and Sheikh(389)	2009	UK	Evaluating eHealth Interventions: the need for continuous systemic evaluation	Framework	Schematic for simplified evaluation process that allows continuous evaluation of an eHealth intervention through the four stages of its lifecycle (inception; requirements and analyses; design, develop and test; implement and deploy)
9	Lilford et al(390)	2009	UK	Evaluating eHealth: How to make evaluation more methodologically robust	Essay	Evaluation of eHealth systems often requires both a quantitative and qualitative approach. Advice observations at patient and system level. Discuss internal and external assessment, formative and summative evaluation. Developed a schematic causal chain showing levels where IT may impact and a schematic representation of development and deployment of IT systems.
10	Medical Research Council(381)	2010	UK	Developing and evaluating complex interventions	Guidance	Describe 'The development-evaluation-implementation process'. Framework consisting of: 1. What makes an intervention complex; 2. The development-evaluation-implementation process'; 3. Developing a complex intervention; 4. Accessing feasibility and piloting methods; 5. Evaluating a complex intervention; 6. Implementation and beyond

Table 70 continued

Ref	First author	Year published	Country	Source focus	Source type	Findings and recommendations
11	Cummings and Turner(391)	2010	Australia	Patients at the Centre: Methodological Considerations for Evaluating Evidence from Health Interventions Involving Patients Use of Web-Based Information Systems	Review	Focus 'on the socio-technical processes by which patients' interests and outcomes are measured, defined and evaluated within health interventions that involve them using web based information systems'. They describe 'an integrated approach that aims to generate evidence about the impact of these types of health interventions that are meaningful at both individual patient and patient cohort levels'.
12	Nykanen(364)	2011	Finland, Denmark, The Netherlands, UK, France, Austria	Guideline for good evaluation practice in health informatics	Guidance	Describe 6 phases of evaluation: 1. Preliminary outline; 2. Study design; 3. Operationalization; 4. Project planning; 5. Execution of the evaluation study; 6. Completion of the evaluation study
13	Brender(365)	2013	Denmark, Netherlands, Finland, UK, Austria	STARE-HI – Statement on Reporting of Evaluation Studies in Health Informatics	Explanation and exploration of STARE-HI guidance	Provides examples and elaborates each component of the STARE-HI statement
14	Khoja(242)	2013	Kenya, Afghanistan, Canada	Conceptual Framework for Development of Comprehensive e-Health Evaluation Tool	Framework based on different theories of evaluation applicable to e-Health	Khoja-Durrani-Scott Framework for eHealth evaluation. 7 evaluation themes identified: health service outcomes; technology outcomes; economic outcomes; behavioural and sociotechnical outcomes; ethical outcomes; readiness and change; policy outcomes. These were tabulated against the four stages of the eHealth life cycle (development; implementation; integration; sustained operation). From this, four separate evaluation tools were developed for the four stages of the eHealth life cycle (not covered in this article)

Table 70 continued

Ref	First author	Year published	Country	Source focus	Source type	Findings and recommendations
15	Kumar et al(392)	2013	USA	Mobile Health Technology Evaluation	Summary of the mHealth Evidence Workshop 2011	Three areas covered: 1. Evaluating assessments; 2. Evaluating interventions; 3. Reshaping evidence generation using mHealth. Mobile technology define as wireless devices and sensors (including mobile phones) that are intended to be worn, carried, or accessed by the person during normal daily activities.

The MRC has developed guidance on developing and evaluating complex interventions. As mentioned, the Chlamydia-OCCP was developed following this guidance and it was an important source of information when evaluating the available evidence base. Although not specifically developed for use with eHealth interventions, as eHealth interventions are by their nature complex interventions, this guidance was a useful adjunct to other relevant literature. The guidance provides information on the development, evaluation and implementation process, with case studies to illustrate their points(381).

Dansky et al state in their introduction to their paper entitled 'a framework for evaluating eHealth research' that 'this article does not endorse specific designs, methods or approaches for conducting eHealth research'(385). The same can be said about much of the literature on evaluating eHealth interventions. One of the main reasons for this is the diverse nature of eHealth (363;364). Therefore, although there is guidance available, it is often non-specific with Yusof et al concluding that 'existing evaluation methods do not provide explicit evaluation categories'(387) and Cummings and Turner observing that 'evaluation of different health information systems requires different methodologies'(391). Ammenworth et al recommend a flexible approach to evaluation, reflecting the length of time it can take to implement, adapt to and exploit novel IT systems, and the 'moving evaluation target' (the continued adaption of the evaluation object throughout the lifecycle of the implementation)(363;393;394).

There is general agreement that 'continuous systematic multifaceted evaluations'(389), which are in-depth and continued throughout the development, implementation and operation, of eHealth interventions are required(242;364;381;382;395). The most useful papers in terms of providing practical guidance as to how an evaluation of an online system can be undertaken was provided by Ammenwerth et al(363) and Turner et al(388). For the latter, paradoxically this information was in the appendices of their report on the evaluation of the accuracy and safety of NHS pathways in an ambulance service operational setting. They describe how different methods were employed in order to do this, including frequency that different

answers to questions were selected, timings, 'bench-testing', clinical review and service performance analysis(388). Although these pathways are designed to be used via the telephone, and therefore involve human contact, the methods used can be extrapolated for use in evaluating an eHealth pathway. Ammenwerth et al take a pragmatic approach to reviewing the challenges of evaluating IT systems. They first list the questions and problems commonly encountered when evaluating an eHealth study, and then describe, provide an analysis of, and possible solutions for, the three key problem areas they have identified: complexity of the evaluation object; complexity of the evaluation project; motivation for evaluation(363).

Murray et al discuss the issues relating to data quality that are present in traditional studies and those that are specific to studies conducted online. The latter include the challenges of independently verifying the integrity of responses to information provided, including demographics, and the effect that changing the mode of delivery has on validated outcome measures. Both of these points can affect the validity of the data collected(396). However, one advantage of using an online intervention is that it is possible to make questions mandatory which removes the issue of non-response(396).

Talmon et al developed a set of guidelines (VATAM (validation of telematics applications in medicine)) for 'the assessment of telematics applications in medicine'. Based on existing evidence, this was composed of two documents, one describing the VATAM approach, and the other providing a knowledge base for users(382). The VATAM website(397), launched in 1996 to host this information, is no longer accessible.

In 2011, two sets of guidelines were developed to provide good practice recommendations for developing and implementing evaluation studies (GEP-HI(364)) and a framework for reporting evaluation studies (STARE-HI(365;398)). In contrast to previous guidelines(387), the former was designed to provide guidance on evaluation of all aspects of the lifecycle of a broad spectrum of eHealth interventions(364). Nykanen et al propose six iterative phases of

evaluation (see Table 70) and stipulate multiple items that should be considered within each phrase(364). STARE-HI was developed to attempt to rectify the variability in quality of reporting of eHealth evaluation studies (365;398-401).

In 2008, Black et al noted that there was no consensus as to how complex eHealth interventions should be evaluated(5). The field has developed since then and the general agreement is that it is vital to adopt a user-centred approach and evaluate all aspects of an eHealth intervention across all parts of its life cycle (5;363;364;382;388;391;392). A number of authors observe that it is important to take a mixed method approach when evaluating eHealth interventions(39;378;384;385;391;400;402;403), with the MRC advocating the same approach for complex interventions(381). In addition, the MRC state that it is important to both understand any barriers to implementation, as well as monitoring the delivery of and being aware of the possibility of unexpected consequences, of a complex intervention(381).

As the majority of the literature on eHealth evaluations failed to provide the detail required to assess the feasibility, acceptability and safety of the Chlamydia-OCCP, I also searched the literature on questionnaire development. Prous et al(404) suggest that, as with any measurement instrument, a valid questionnaire needs:

1. Feasibility (simplicity, viability, patient, user and researcher acceptance)
2. Reliability and precision (mistake free measurements)
3. Content validity (adequate for the problem intended for measure)
4. Construct validity (reflecting underlying theory in the phenomenon or concept to be measured)
5. Sensitivity to change (capable of measuring change, both in different individuals as in the response of the same individual through time).

Weston et al have developed and validated a sexual health clinic patient satisfaction survey. This has been designed to be used in traditional sexual health settings and the survey is not validated or adapted for use in an online setting. However, it does provide useful guidance in

terms of both content for a service evaluation of an online clinic, along with the methods employed to validate the survey(405).

Grey literature

There are several organisations, including the NHS(304) and NICE(304), who accredit clinical pathways.

NHS Pathways is used within the NHS to provide ‘a clinical assessment tool designed to provide consistent assessment across all telephone access points’(304). The Health and Social Care Information Centre website pages describe how the pathways have been developed, and similar methods have been used in the development of this online clinical pathway. NHS Pathways is mainly geared towards urgent and emergency care provision, which clinically has both similarities and differences to the scenario we describe(304). Although developed to be used via phone conversations, the methodology behind the pathways, I believed that the methods could be adapted and extrapolated for use online.

NICE Pathways is ‘an online tool for health and social care professionals that brings together all related NICE guidance and associated products in a set of interactive topic-based diagrams’(304). It is designed to facilitate the finding and utilisation of NICE guidance. The only NICE guidance applicable to the clinical care pathway that we have developed is ‘Preventing Sexually Transmitted Infections and Under-18 Conceptions Overview’(406). NICE pathways do not provide any guidance on how to evaluate the interventions from an eHealth perspective.

Synthesis of findings

I believed that the optimal approach would be to combine relevant findings from the literature search with application of techniques described by Pequegnat et al(407), Murray et al(396), Eysenbach(366), Bailey et al(190), and Scherbatykh et al to strengthen the use of this

in an online scenario. Efficacy of the pathway will be established but is outside the remit of my doctoral research.

As recommended by Catwell and Sheikh, the formative evaluation process has been an integral part of both the development and implementation of the Chlamydia-OCCP, and will continue when the pathway is rolled out in a full-scale trial. As described in chapter 5, the eClinical Care Pathway Framework is an iterative process with evaluation at various steps leading to changes to different components of the pathway which are then re-evaluated.

3. PROPOSED EVALUATION METHODS

Synthesising the recommendations from these sources, along with the objectives of the eSTI² pilot study, I concluded that the following seven components would provide a wide ranging robust approach to evaluating if the chlamydia-OCCP is fit for purpose:

1. Assessment of acceptability to users
2. Assessment of time taken to complete
3. Assessment of the completion rate
4. Assessment of usability
5. Assessment of the content and structure of the online clinical consultation
6. Assessment of users' comprehension of the online clinical consultation and integrity of answers
7. Safety-related outcomes and detection of adverse effects

Table 71 below summarises the evidence base for each evaluation method.

Table 71: Summary of the evidence base for each evaluation method

Evaluation method	Evidence to support its use
1 Assessment of acceptability to users	Ammenworth et al (393); Cummings and Turner(391); Prous et al (404); Shcherbatykh et al (367); Turner et al (388); Medical Research Council(381)
2 Assessment of the length of time it takes users to complete the online clinical consultation	Bowling(402); Lilford et al (390); Prous et al (404)
3 Assessment of the completion rate	Prous et al (404); Turner et al(388)
4 Assessment of Usability	Ammenworth et al (363); Brown et al (380); Cummings and Turner(391); Gustafson (384); Leloch et al(394); Shcherbatykh(367); Turner et al (388); Medical Research Council(381)
5 Assessment of the content and structure of the online clinical consultation	Gustafson (384); Karras et al (408); Lobach et al(394); May (386); Murray et al(396); Prous et al (404); Rothrock et al(368); Shcherbatykh et al(367); Turner et al (388); Weston et al; Medical Research Council(381)
6 Assessment of users' comprehension of the online clinical consultation and integrity of answers	Ammenworth et al (363); Gustafson (384); Rothrock et al(368); Turner et al (388)
7 Safety-related outcomes and detection of adverse effects	Ammenworth et al (363)Catwell and Sheikh (389);Lilford et al (390) Shcherbatykh(367); Turner (388);Medical Research Council (381)

Here, I will discuss each of the evaluation methods listed in Table 71, describing evidence for and methods used pre- and post- exploratory pilot study commencement. The detail of the evaluation approaches pre-implementation of the exploratory study are described in detail in Chapter 5. I will discuss the quantitative evaluation methods used post-exploratory study commencing in more detail in Section 4 of this Chapter.

1. ASSESSMENT OF ACCEPTABILITY TO USERS

Pre-exploratory study commencing

Prior to the development of the Chlamydia-OCCP, two sets of qualitative research were conducted, by two other eSTI² researchers. These were a planned part of work to which I contributed only indirectly. The acceptability of the pathway to young people, a target

population, was explored by an eSTI² researcher using qualitative methodology for semi-structured interviews at Further Education colleges. This included using an animated 'mock-up' of the basic pathway, developed by the human computer interface researcher, to give the young people an idea of how we envisaged people testing for STIs, accessing their results and being managed remotely (228). This information informed the development of the pathway and informed the patient important outcomes for evaluation. A human computer interface researcher conducted focus groups to inform the design of the mobile application interface(181).

Post-exploratory study commencing

As well as the methods described in Chapter 3, both quantitative and qualitative post trial evaluations of acceptability were conducted. This entailed four separate activities (qualitative interviews, quantitative human computer interface evaluation, service evaluation and quantitative survey of negative users), two (qualitative interviews and quantitative human computer interface evaluation) of which were conducted by other eSTI² researchers and two of which I undertook.

Qualitative evaluation

Another eSTI² PhD student conducted semi-structured qualitative interviews with approximately 40 users who consented to the online clinical consultation, focussing on acceptability and feasibility.

Quantitative Human Computer Interface evaluation – patients testing positive for chlamydia

A human computer interface researcher designed a quantitative survey to evaluate the acceptability and usability of the web application interface. We incorporated this short survey at the end of the online clinical consultation. It was only completed by users who consented and were able to complete the consultation, and was therefore subject to selection bias.

However, as this was an online evaluation of an online intervention, it did help optimise the study's external validity.

Quantitative service evaluation – patients testing positive for chlamydia

I designed a quantitative follow-up survey that was administered to all users who consented to the online clinical consultation. The development of this is discussed below. Although online evaluation of an online trial increases the external validity, and it is usually preferable for questionnaires to be self-administered(404), I chose to incorporate the questionnaire into the two week health adviser follow-up that was conducted by phone. Reasons for this decision included maximising the number of patients who completed the survey. High loss to follow-up is common with online surveys(396) with incentives increasing response (402). Although Bailey et al achieved a response rate of 72.2% to a three month post-intervention questionnaire, they offered financial incentives and this response rate required repeated attempts (maximum of five) at follow-up (190). As well as not having a budget to offer financial incentives, our user group had been diagnosed with an STI and required clinical follow-up; we felt that it wouldn't be ethical to repeatedly contact them solely to complete an online service evaluation. In addition, although the research health adviser follow-up, and therefore the survey, was conducted potentially two weeks after the patients had used the system, and would therefore be subject to recall bias, in order to capture patients' experiences of collecting antibiotics from pharmacies, and partner notification outcomes, it was necessary to have this time gap. Finally, these patients may already have been asked to complete the short human computer interface survey at the end of the consultation and, if they fit the sampling frame, would be offered a qualitative interview.

Quantitative evaluation – patients testing negative for chlamydia

I designed a short online survey for those patients who accessed the results service and tested negative for chlamydia. The development of this is discussed in section 4 below.

2. ASSESSMENT OF THE LENGTH OF TIME IT TAKES USERS TO COMPLETE THE ONLINE CLINICAL CONSULTATION

Pre-exploratory study commencing

This was assessed as part of the user-centred interface testing (conducted by the human computer interface researcher), described in Chapter 5

Post-exploratory study commencing

During the exploratory study, time-stamping(363;402) was used to capture the timing of various end points in order to inform the length of time that users took to complete the online clinical consultation. This was captured as part of the export data sheet and will be analysed in terms of both feasibility and cost-effectiveness. The latter will be conducted by the eSTI² health economics doctoral student.

3. ASSESSMENT OF THE COMPLETION RATE

Post-exploratory study commencing

Patient outcomes(368;381) were included in the database specification and export data sheet (see Chapter 5) and the following was recorded and will be analysed:

1. Proportion of patients (testing positive and negative for chlamydia) who accessed their results using the online results service
2. Proportion of patients (testing positive for chlamydia) who consented to the online clinical consultation
3. Proportion of patients who completed the online clinical consultation
4. Proportion of patients who are known to have been treated (both online and in traditional services)
5. Proportion of patients who were followed up by a research health adviser at two weeks

6. Partner notification outcomes

Where participants, who consented, dropped off the pathway was recorded and audited at one month and then on a three monthly basis so that amendments could be made if necessary. These patients were still followed up at two weeks by a research health advisor and both treatment and partner notification outcomes were recorded.

4. ASSESSMENT OF USABILITY

Pre-exploratory study commencing

Prior to the exploratory study commencing, a Human Computer Interface researcher undertook two qualitative studies to inform the development of the pathway. This is discussed in the background and development chapter. In addition, we had at least one human computer interface researcher as part of the expert group in the development and implementation of the exploratory study.

Post-exploratory study commencing

This was measured using the methods described under 'Assessment of the acceptability to users'.

5. ASSESSMENT OF THE CONTENT AND STRUCTURE OF THE ONLINE CLINICAL CONSULTATION

Pre-exploratory study commencing

The following methods were used to evaluate the different facets of the content and structure of the online clinical consultation:

a. Expert review

As discussed in Chapter 5, both clinical and non-clinical experts have been involved at multiple stages with the development of the online clinical consultation. The clinical experts have judged that: the questions appear to be reasonable, relevant, unambiguous and clear; the content of the questions comprehensively cover what is required to ensure that the appropriate clinical outcome is ascertained and that it is safe and appropriate to prescribe(342;404).

In addition, the chlamydia-OCCP has been presented to, and discussed with, sexual health clinicians, pharmacists, and other health care professionals, at different time points in the development process.

b. Cognitive testing (as described in Chapter 5)

c. User-centred interface testing (as described in Chapter 5)

Post-exploratory study commencing:

Comparison of data collected with data collected in clinic

Data was collected from clinic records for all patients who had been diagnosed at Barts Sexual Health Centre and St George's Sexual Health Clinic, and who had consented to online management. In addition data was collected for all patients (GUM and NCSP) who dropped off the pathway and were directed into Barts Sexual Health Centre and St George's Sexual Health Clinic.

This data will be compared with the data inputted online to check the internal validity(342;404) of the online responses, and the appropriateness of diverting patients off of the pathway because of clinical reasons. This will be discussed in more detail below.

Quantitative service evaluation

I included questions in the service evaluation, conducted at the Health Adviser follow-up at two weeks, to establish whether patients felt that they understood the information given with

their results and throughout the online clinical consultation, and whether they felt that this information was sufficient.

6. ASSESSMENT OF USERS' ABILITY TO COMPREHEND THE ONLINE CLINICAL CONSULTATION AND THE INTEGRITY OF THEIR RESPONSES

Pre-exploratory study commencing

Cognitive testing (see chapter 5) was used to ensure that participants were able to comprehend and correctly interpret the online clinical consultation prior to the exploratory study commencing.

Post-exploratory study commencing

Comparison of patient inputted data with data collected in clinic will be used to as a surrogate marker of patients' ability to comprehend the online clinical consultation and to assess the integrity of their online responses.

Another approach would be to test the online clinical pathway pre and post consultation with patients diagnosed with chlamydia. However, this would require a large number of patients, and resources, which are beyond the scope of the present study. In addition, Tideman et al and Richens et al have shown, in randomised controlled trials, that Computer Assisted Self Interview (CASI) is a suitable substitute for face-to-face interviews in sexual health(40;152), and CASI has already successfully been incorporated into clinical practice on the basis of this evidence(142;144).

7. SAFETY-RELATED OUTCOMES AND DETECTION OF ADVERSE EFFECTS

Pre-exploratory study commencing

As part of the development of the Chlamydia-OCCP (see Chapter 5), a senior researcher and I tested a demonstration version of the online clinical consultation to ensure that: 1. All the data

was collected and coded accurately in the export data sheet; 2.The logic was correct; 3.

Patients came off the pathway when it was clinically not suitable for them to continue.

Post-exploratory study commencing

As well as the outcomes discussed in assessment of the completion rate, I felt that, where possible, it was also important to measure the proportion of patients that received appropriate management given the symptoms and drug/allergy history reported. This was captured using the following tools (already described): export data sheet, data collected from clinic notes for patients who dropped off the pathway, and health adviser follow-up. I will analyse each patient record, looking at symptoms reported in initial clinic consultation (for GUM patients), symptoms reported online, symptoms and management reported in clinic review (for patients who dropped off the pathway and came back into a study clinic), and health adviser follow-up, and diagnosis made/treatment given. From this, I will assess, with a Consultant GUM physician, whether: 1.The criteria for patients dropping off the pathway was correct; 2. Patients received appropriate management.

As this is a novel remote online clinical care pathway, where patients are potentially able to access treatment without being reviewed by a health care professional, it was imperative that we captured any adverse effects or clinical incidents.

Shcherbatykh note that, in their experience, questionnaires combined with qualitative interviews are a good way of picking up adverse effects(367). Therefore, as well as the clinical helpline, notes of which were captured on the export data sheet, I included questions in the health adviser follow-up, to capture clinical adverse events, and service evaluation, to capture non-clinical adverse events. The qualitative researcher included questions in her topic guide to ensure that potential issues were explored.

As part of the data monitoring and review process, review meetings where interim data was provided were conducted at one, three and six months following the start of the start of the study.

Table 72 below summarises these methods.

Table 72: Summary of methods of evaluation and evaluation tools

Element to evaluate	Method of evaluation	Evaluation tool
Feasibility	Assessment of length of time it takes users to complete the online clinical consultation	User-centred interface testing
		Data captured in export data sheet from online clinical consultation
	Assessment of the completion rate	Data captured in export data sheet from online clinical consultation and health adviser follow-up
	Assessment of usability	Qualitative interviews
		Human computer interaction quantitative short online survey
		Service evaluation (quantitative survey)
		Quantitative survey for negative users
	Assessment of the content and structure of the online clinical consultation	Expert review
		Cognitive testing
		User-centred interface testing
	Assessment of users ability to comprehend the online clinical consultation and the integrity of their responses	Comparison of data collected online with data collected in clinic
		Cognitive testing
Acceptability	Assessment of acceptability to users	Comparison of data collected online with data collected in clinic
		Qualitative interviews
		Human computer interface quantitative short online survey
		Service evaluation (quantitative survey)
	Assessment of the content and structure of the online clinical consultation	Quantitative survey for negative users
		Expert review
Safety	Clinical outcomes and detection of adverse effects	Cognitive testing
		User-centred interface testing
		Data captured in export data sheet from online clinical consultation, clinical helpline and health adviser follow-up
		Service evaluation (quantitative survey)
		Qualitative interviews
		Comparison of data collected online with data collected in clinic

Highlighted cells are work conducted by other eSTI² researchers

I will now discuss the quantitative evaluation tools that I developed to address the different evaluation approaches.

4. QUANTITATIVE EVALUATION TOOLS

The export data sheet, which captures all the data collected from the online clinical consultation, is described in Chapter 5.

4.1 SERVICE EVALUATION FOR PATIENTS TESTING POSITIVE FOR CHLAMYDIA

It is standard practice when designing a questionnaire to include techniques that test the integrity and consistency of the participant's answers, along with providing internal validity. As these patients had been diagnosed with an infection, had been through an online consultation and clinical health adviser follow-up, would be offered the opportunity to participate in qualitative interviews, and may have opted to complete the human computer interface usability survey, I felt that it was imperative that this survey was short and only asked questions that were absolutely necessary to evaluate the system. This therefore restricted my ability to introduce questions that would flag if a patient was 'yes-saying'. It was possible, however, to include questions that helped target appropriate questions to the patient, and allowed verification of their answers against other questions asked in the online clinical consultation. One example of this is whether the patient had tested for chlamydia prior to this episode; this question was included in the online clinical consultation and in the service evaluation. It will also be possible to check for incongruous answers with the questions that I have employed. An example of this is checking the response patients gave to acceptability of the clinical care pathway against whether they were happy with their overall experience.

As previously described, this survey was designed to be asked during the health adviser two week follow-up, after the clinical follow-up section. It therefore needed to be pithy and

relevant to the patient. In order to achieve this, I employed a skip pattern of questioning (190), as with the online clinical consultation, which meant that the patients were only asked questions that were relevant to their experience.

I based the content of the questions on: our needs in order to evaluate and validate the online clinical care pathway; questions employed by other researchers when evaluating a sexual health computer assisted self- interview(CASI) (152), an express sexual health clinic(144), an online sexual health promotion website(190;351), the BASHH Patient Survey Questionnaire(409), and previous surveys of preferences for receiving test results(315;317;318). Nicholas et al, in their qualitative evaluation of the Sexunzipped website, found that young people would have preferred to have a “middle of the road” option (351). Although it was not possible to employ this during the online clinical consultation, I did ensure that this option was available for the service evaluation questions.

Weston et al, in their development of a patient satisfaction survey for use in Sexual Health Clinics, undertook qualitative research to identify which key themes were of greatest importance to patients when attending a Sexual Health Clinic. The five major areas they identified were: clinic location; availability of appointments; staff attitude to patients; effective delivery of information; confidentiality within clinic. Our needs, in surveying a patient group that had accessed an eSexual Health Clinic were different, with the first two areas being redundant. The areas I identified as being important were: patient satisfaction with the eSTI² results service(363); patient satisfaction with the online clinical consultation (including content of questions and information provided)(363); patient satisfaction with the clinical helpline; how this experience compared to previous experiences of testing for chlamydia (for patients with previous testing experience); patient experience of collection of antibiotics from their nominated pharmacy. The only staff contact that users of the eSexual Health Clinic would have was with the health adviser, which was why I chose to ask questions relating to whether they used the clinical helpline and, if so how helpful they found this service.

I initially planned to cognitively test the questionnaire and then trial it with patients diagnosed with chlamydia in clinic. However, due to time constraints this was not possible. Instead, I sought advice from members of the expert group (mentioned in Chapter 5).

I then arranged to discuss the health advisers' impressions of the questionnaire two months after commencing the study. This coincided with the training of two new Health Advisers who were joining the team. Points raised included: confusion over wording/interpretation of the questions; questions over potential duplication of questions; concerns over how the questions were to be asked. I then went back to the questionnaire, re-established the information we were trying to gather and used this to rationalise the questions. I explored using the Likert Scale(410) however all Health Advisers felt this would be more confusing in terms of trying to explain it over the phone, was likely to take longer and was more likely to lead to misinterpretation. Following this meeting, I then engaged with two researchers with experience of quantitative surveys, one of whom was the eSTI² PhD student conducting the qualitative follow-ups. I then revised the questionnaire and re-evaluated it after a month. At which stage, all three health advisers agreed that there were no further changes required.

To ensure that all health advisers were asking the questions in the same way, and were adhering to the standard operating procedure, I went through the questionnaire with them all individually and then together, and we decided together the optimal approach to asking the questions.

Once the service evaluation had been placed on the demonstration system, I used white box testing (407) to ensure that the question flow and logic were correct, depending on the responses given. I then checked that this was coding correctly on the export data sheet.

The final quantitative service evaluation is shown in Table 73 below.

Table 73: Final quantitative service evaluation

Data item	Description	Field Name	Response Categories and Coding Structure
6	<p>Were you happy with the text message that you were sent with the link to access your result? <i>[index patients only]</i></p> <p><i>Tick all that apply</i></p>	TEXTOK	<ol style="list-style-type: none"> 1. Yes, I was happy 2. No I would rather have received the link in an email 3. No I would rather it had the result of the test in the text message 4. No it wasn't clear 5. Other (free text)
7	<p>Were you happy with the message that you received informing you that you could access treatment online? <i>[sexual partners only]</i></p> <p><i>Tick all that apply</i></p>	SPTEXTOK	<ol style="list-style-type: none"> 1. Yes I was happy 2. No it wasn't clear 3. No it was too blunt 4. Other (free text) 5. Not applicable
8	<p>When you accessed your results <i>[index patient]</i>/the online clinic <i>[sexual partners]</i>, did you think the amount of information you were given about chlamydia was:</p>	RESINFOAMT	<ol style="list-style-type: none"> 1. Not enough 2. About right 3. Too much 4. Not applicable
9	<p>Do you think this information on chlamydia and <i>management options</i> was</p>	RESINFOOK	<ol style="list-style-type: none"> 1. Very easy to understand 2. Easy to understand 3. Neither easy nor difficult to understand 4. Difficult to understand 5. Very difficult to understand 6. Not applicable
10	<p>How easy did you find the questions in the online clinic to complete?</p>	EASYOCC	<ol style="list-style-type: none"> 1. Very easy 2. Easy 3. Neither easy nor difficult 4. Difficult 5. Very difficult 6. Not applicable

11	How comfortable did you feel answering these questions?	COMFORTOCC	<ol style="list-style-type: none"> 1. Very comfortable 2. Comfortable 3. Neither comfortable nor uncomfortable 4. Uncomfortable 5. Very uncomfortable 6. Not applicable
12	How comfortable were you answering these questions online compared to if you answered these questions face-to-face with a doctor or nurse?	COMFOCCFTF	<ol style="list-style-type: none"> 1. Much more comfortable online compared to face-to-face 2. More comfortable online compared to face-to-face 3. About the same 4. Less comfortable online compared to face-to-face 5. Much less comfortable online compared to face-to-face 6. Not applicable
13	Whilst going through the online clinic, did you think the amount of information you were given was	INFOOCCAMT	<ol style="list-style-type: none"> 1. Not enough 2. About right 3. Too much 4. Not applicable
14	Did you think this information was	INFOOCCOK	<ol style="list-style-type: none"> 1. Very easy to understand 2. Easy to understand 3. Neither easy nor difficult to understand 4. Difficult to understand 5. Very difficult to understand 6. Not applicable
15	Any other comments spontaneously made by index patient on results service or online consultation [No question asked]	FREETXTOK	Free text
16	Did you use the telephone clinical helpline	CLINHELP	<ol style="list-style-type: none"> 1. Yes (go to 16a) 2. No (go to 17)
16a	Did you find it helpful?	HELPFUL	<ol style="list-style-type: none"> 1. Yes 2. No (go to 16b)

			3. Unable to remember
16b	Why not?	NOTHELPFUL	1. Opening hours too restrictive 2. Unable to answer question/query 3. Other reason – free text
17	Have you had chlamydia before?	PREVCHLAM	1. Yes (go to 17a) 2. No (go to 18)
17a	How did the online results system compare to the last experience of getting your results? <i>[Do not ask sexual partners]</i>	OCCOMPARERES	1. Much better 2. Better 3. About the same 4. Worse 5. Much worse
17b	Would you use this method of accessing your results again? <i>[Do not ask sexual partners]</i>	METHAGAIN	1. Yes 2. No 3. Unsure
17c	How did you using the online clinic to get antibiotic treatment compare to your last experience of getting antibiotics?	OCCOMPARETREAT	1. Much better 2. Better 3. About the same 4. Worse 5. Much worse 6. Not applicable
17d	Would you use this method of accessing your antibiotic treatment again?	ACCESSAGAIN	1. Yes 2. No 3. Unsure

18	How did you access the online clinic? <i>Tick all that apply</i>	HOWACCOCC	1. Mobile phone 2. Desktop computer 3. Lap top 4. Tablet/iPad 5. Combination (i.e. swapped from one to the other) Free text
19	Would you rather have had a face-to-face consultation with a doctor or nurse?	PREFACE	1. Yes (if yes, drop down box with free text) 2. No 3. Unsure
20	Did you have any problems getting your treatment from the pharmacy?	PROBPHARM	1. Yes (if yes, drop down box with free text) 2. No 3. Not applicable
21	Would you recommend this online clinic to your friends?	RECOMMEND	1. Yes 2. No 3. Unsure
22	Overall, how would you rate the care you received via the online clinic?	RATECARE	1. Excellent 2. Very good 3. Good 4. Fair 5. Poor 6. Very Poor
23	Suitable for qualitative interview?	QUALINT	1. Yes (automatically feeds to 24) 2. No
24	Permission to follow-up by researcher?	PERFURESEA	1. Yes 2. No If yes, drop down text box : best time to call for interview

4.2 QUANTITATIVE SURVEY FOR PATIENTS TESTING NEGATIVE FOR CHLAMYDIA

I decided to add a short survey for people who tested negative for chlamydia in order to get feedback on how they found using the eSTI² results service. As this was an online evaluation of an online intervention, with no intermediary, it optimised external validity(411). In order to maximise the usefulness of this information, the initial question asked whether the users had

experience of testing for chlamydia prior to this episode. I did this as prior testing experience could influence their impression of the eSTI² results service.

Sources used to inform the content of the survey included Brown et al(315), Labacher and Mitchell(318), and Martin et al(317). As with the service evaluation for patients testing positive for chlamydia, I used a skip pattern of questioning, white box testing and checked the coding of the survey on the export data sheet prior to the survey being put on to the live system.

Table 74 below contains the questions asked in the negative survey.

Table 74: Negative quantitative survey

Data item	Description	Field name	Response categories and coding structure
2d	Negative survey	TICKNEGSURVEY	As this is a new way of getting results, we would be grateful if you could answer a short survey : click here (If clicked filters to 2e)
2e	Neg results Survey, ever tested	NEGSRTTEST	Is this the first time you have been tested for chlamydia? No (dropdown to 2e (v)) Yes (dropdown to 2e (i))
2e(i)	Neg results Survey, previously tested	NEGSRPVRES	How have you got your test results in the past? (tick all that apply)? 1. Text message 2. Phone call 3. Letter 4. Email 5. Other
2e(ii)	Neg results Survey, results method comparison	NEGSRCOMPARE	Do you think the way you got your result this time was: 1. Much better 2. Better 3. About the same 4. Worse 5. Much worse
2e(iii)	Neg results Survey, future	NEGSRFUT	Would you be happy to get your results this way in the future? 1. Yes 2. No

2e(iv)	Neg results Survey comments	NEGSRCOMM	If you have any other comments please write them in the box below: ..TEXT BOX
2e(v)	Neg results Survey given results today	NEGSRRSTXT	Were you happy with the way you were given your results (a text to say that you could access your results online) 1.Yes 2.No
2e(vi)	Neg results Survey happy to receive results online if had chlamydia in future	NEGSRFUTRST	If your test showed you had chlamydia in the future, would you be happy to get your results this way if your test was positive 1. Yes 2. No
2e(vii)	Neg results Survey method preference of getting results	NEGSRPREF	Rather than logging in to get your results, would you have rather have received your result by: 1. An email with a link to access your results instead of a text Yes/No 2. A text saying 'The result of your chlamydia test is negative/positive. You do not/do have chlamydia' Yes/No 3. An email saying 'The result of your chlamydia test is negative/positive. You do not/do have chlamydia' Yes/No 4. Other way: FREE TEXT
2e(viii)	Neg results Survey other comments	NEGSRCOMMENT	Text box If you have any other comments please write them in the box below:

4.3 COMPARISON OF PATIENT INPUTTED DATA WITH DATA COLLECTED IN CLINIC

For those patients recruited from the Barts Health Sexual Health Centre and St George's Sexual Health Clinic, and for patients who dropped off the pathway and came into these clinics, data entered online by patients will be compared with data collected from the same patients in clinic. The data will be anonymised. The data items that will be compared are illustrated in Table 75 below.

Table 75: Data items to be compared between patient inputted data and data collected in clinic

	All participants	Gender specific
Demographics	<ul style="list-style-type: none"> • Age • Ethnicity • Postcode • Email address • Gender • Asymptomatic screen 	
Symptoms	<ul style="list-style-type: none"> • Rash, sores or blisters • Skin lumps 	<p>Female: presence of</p> <ul style="list-style-type: none"> • Abdominal/pelvic pain • Inter-menstrual bleeding • Post-coital bleeding • Dyspareunia <p>Male: presence of</p> <ul style="list-style-type: none"> • Testicular or scrotal pain • Anal pain
Medication and allergy history	<ul style="list-style-type: none"> • Regular medications • Cardiac history or drugs • Drug allergies • Myasthenia gravis, liver or kidney problems • Nut/soya allergy 	<p>Female</p> <ul style="list-style-type: none"> • Pregnancy • Breast feeding • Need for emergency contraception
History of previous STIs	<ul style="list-style-type: none"> • Previous chlamydia • When 	

	All participants	Gender specific
Previous HIV testing	<ul style="list-style-type: none"> • Previously tested for HIV • When • Result 	
Sexual History	<ul style="list-style-type: none"> • Number of sexual partners • Sexual preference • Type of sex • Condom use 	
Risk assessment	<ul style="list-style-type: none"> • History of Injecting drug use • History of paying or receiving money for sex • Sexual partner outside UK • Hepatitis B vaccination 	<p>Female:</p> <ul style="list-style-type: none"> • Male partner ever had sex with a man <p>Male:</p> <ul style="list-style-type: none"> • Ever had sex with a man
Diagnosis and management	<ul style="list-style-type: none"> • Patient examined • Diagnoses made • Treatment given 	<p>Female:</p> <ul style="list-style-type: none"> • PV examination performed

6. SUMMARY OF PATIENT INVOLVEMENT IN EVALUATION OF THE PATHWAY

Patients have been involved with evaluating the pathway prior to study commencing in the following ways:

1. Preliminary acceptability and interface design qualitative work conducted by other eSTI² researchers
2. Cognitive interviews
3. Usability lab-based testing and further cognitive testing with the demonstration version of the eSexual Health Clinic

Patients have been involved with evaluating the pathway once the study commenced in the following ways:

1. Short acceptability quantitative survey for people testing negative for chlamydia (see page 310)
2. Usability quantitative online survey at the end of the online clinical consultation (designed by another eSTI² researcher)
3. Quantitative service evaluation conducted at health adviser follow-up (see page 305)
4. Qualitative interviews, by another eSTI² researcher, conducted with patients who consented to the online pathway and consented to be contacted at health adviser follow-up

6. DISCUSSION

4.1 MAIN FINDINGS

eSexual Health is progressively being incorporated into everyday clinical practice, with a variable evidence base to support it. In terms of both diagnostic and digital technological development, we are close to patients being able to self-sample, self-test, to be diagnosed, managed and able to access treatment remote from direct health care professional care and traditional sexual health services. However, there are several barriers to this, some of which I, and other members of the eSTI² consortium, have addressed and proposed solutions for.

At present there is little directly applicable guidance and evidence available when developing a novel online clinical care pathway, taking a patient from diagnosis through management remotely. There is, however, an existing evidence base that can be adapted and utilised to inform this development. One of my key findings was that, depending on the context, the sequence of a consultation needs to be adapted to meet the needs of the online situation. In the case of the Chlamydia Online Clinical Care Pathway, this has had a major impact on the structure and content of the online clinical consultation. In order to facilitate this, and to help overcome the current lack in guidance and structure, I have developed the eClinical Care Pathway Framework.

I have shown that the eClinical Care Pathway Framework can be used to develop a robust, evidence based, online clinical care pathway. This framework has the potential to be applied to the management of other STIs and other medical conditions.

Any clinical care pathway must be feasible, acceptable and safe for users. This is of paramount importance when an automated online clinical decision system is used, with potentially no

contact with a healthcare professional between receiving a diagnosis and accessing treatment. In this chapter I have described the current evidence base and guidance for evaluation of such an online clinical care pathway, and the methods that I have employed to assess whether the Chlamydia-OCCP is feasible, acceptable and safe.

We have used a comprehensive mixed-method, multi-disciplinary, multi-institutional approach to assess these three major aspects, employing evaluation methods at all stages of the pathway lifecycle in a positive feedback loop that has allowed us to address barriers to implementation in a timely manner. As with Dansky et al(385), we have had to adopt a flexible/dynamic approach to protocol, procedures and evaluation method content in order to be able to do this. Although we applied a robust methodological approach to developing and implementing the Chlamydia-OCCP, as described in Chapters 4 and 5, it was not possible to predict the issues that would arise during the exploratory study. This reinforces the importance of piloting and rigorously evaluating all aspects of novel eHealth interventions.

Traditional methods of research design, implementation and evaluation are not fit for purpose for eHealth interventions(379). Although there is an established literature on evaluating eHealth, this needs to be adapted and made specific for individual interventions. For example, although there were aspects of the Khoja-Durrani-Scott Evaluation tools (242;412)that were helpful in developing this evaluation, the majority of the content was not relevant for the evaluation of the Chlamydia-OCCP. They discuss validating the evaluation tools but do not describe how they went about doing this(242).

At present in the UK, there is no mode of accrediting this type of pathway as it does not fall under the auspices of NHS pathways or NICE pathways.

4.2 STRENGTHS/WEAKNESSES/LIMITATIONS

Methodology

The employment of a novel framework (eCCPF) and a continuous evaluation process, with the feeding back of findings from operational implementation into the system, highlighted as an important part of the evaluation process of eHealth interventions by both Lilford et al(390) and Turner et al(388), enhanced the robustness of our methods(388). For example, from conversations that the health adviser had with patients, data collected as part of the health adviser follow-up and in qualitative interviews, it became apparent within a couple of months of the pilot study commencing that: 1. Many patients did not understand how the online partner notification process worked; 2. There were issues with patients collecting their medication from pharmacies. This is discussed further in Chapter 5, however, we were able to adapt the online clinical consultation, text message that the patient was sent with the pharmacy information on it, and service evaluation in order to resolve these issues in a timely manner.

As Dansky et al(385) suggest, communication between the eSTI² research group and the other stakeholders involved in the study, and within the eSTI² research group, has been key to the development, implementation and evaluation of the Chlamydia-OCCP.

As advised by May(386), we have begun to examine how this eHealth intervention could be embedded within existing clinical services.

Weaknesses of the methods that I have developed and used include only using internal assessment(390), and not validating the service evaluation questionnaire and negative quantitative survey prior to use in the exploratory study. In addition, ideally I would have cognitively tested the questionnaires. Assessment of intra-observability and sensitivity to change are not covered using these methods of evaluation. Test-retest reliability would be difficult to apply to the methodology described above. In addition, Turner et al found only

limited benefit of repeating sensitive questions in their sexual health study(413). As this tool is being used at one point in time, there is no need for it to be capable of measuring change in an individual over time.

Furthermore, the data comparison between data collected in clinic and that collected online is, for the most part, not going to be directly comparable and therefore it will be difficult to draw any statistical robust conclusions from this comparison. A more scientifically robust method of evaluation would have been to have conducted a study whereby patients completed both an online consultation and a traditional consultation with the same questions being asked in both consultations. In this situation it would be necessary for half of the patients to have the online consultation first and then the traditional consultation, and half to have the traditional consultation first, followed by the online consultation.

C-OCCP Pathway

A considerable amount of work has gone into the development of the C-OCCP, which is a complex eHealth intervention. The concern therefore needs to be raised as to how easy it will be to maintain and to keep updated, particularly with the lack of regulatory and professional guidelines. However, I believe that, having got the fundamental structure in place, it will be relatively easy to update and maintain this pathway as long as, in the absence of national guidelines, internal/local guidelines are put in place.

4.3 MEANING AND IMPLICATIONS

The volume, diversity and rapidly evolving nature of eHealth literature, including grey literature, is a barrier when trying to implement a novel online clinical care pathway within the NHS. In addition, the Chlamydia Online Clinical Care Pathway transcends multiple different

regulatory and professional bodies, none of which have the capacity at present to provide specific guidance and accreditation for this type of complex intervention. By adopting a robust methodological approach, with the development and application of a novel framework, I have been able to adapt and apply the existing evidence base to inform the development of and create the Chlamydia Online Clinical Care Pathway

Although there is literature available on evaluating eHealth interventions, much of this is focussed on behavioural interventions and needs to be adapted to the intervention. I have demonstrated that it is possible to develop the methods to establish that an online clinical care pathway is feasible, acceptable and safe. By adopting a multifaceted continuous evaluation approach, it is possible to identify issues with the pathway at an early stage and to adapt the pathway and evaluation, as necessary, in a timely manner.

4.4 RECOMMENDATIONS

My recommendations include: 1. Allocating at least as much time to the development of the evaluation of an online clinical care pathway as you do to the creation of the pathway; 2.

Mapping the evaluation methods against your objectives and against the feasibility, acceptability and safety of the pathway to ensure that all aspects are covered; 3. Using a mixed methods approach using a multidisciplinary, multi-institutional team; 4. Continually evaluating all stages of development and piloting of the pathway.

4.5 UNANSWERED QUESTIONS AND FUTURE RESEARCH

Although I believe that the eClinical Care Pathway Framework can be adapted for use with other STIs/sexual health conditions and potentially for use in other specialities, this has not as yet been tested.

It is important to validate both the online clinical care pathway and the quantitative methods of evaluation. I intend to explore this as part of my post-doctoral research. Once a full analysis and evaluation of the Chlamydia-OCCP exploratory study has been conducted, it is needs to be implemented as a full scale trial.. In order to be feasible and sustainable in the current NHS, it is important that the pathway can be integrated with existing services and into existing systems (408). Whether this is feasible within the current NHS IT infrastructure remains to be seen.

Chapter 7: Conclusions

The prevalence and incidence of STIs remain unacceptably high within England. Sexual health services are under increasing pressure to provide leaner, more cost-effective services and ensure barriers to access are reduced against a backdrop of financial austerity within the NHS as a whole and significant change in commissioning structures. More broadly across the NHS, policy promotes self-managed and remote care. eHealth potentially offers an opportunity to address these pressures, as well as providing patients with the easily accessible knowledge that they require to make informed decisions, whilst facilitating data collection for both clinical and public health needs. However, much of the infrastructure and legislation/regulation and best practice guidance required to support such a shift in provision of care has been designed for traditional, non-eHealth, service provision and is not fit for purpose for innovative eHealth interventions. However, there is always likely to be a lag between innovation and regulations/guidance and this needs to be borne in mind when legislation and regulations are being introduced or updated to ensure that they are not so prescriptive that they restrict advancement.

This body of work has focussed on online health, specifically related to sexual health and STIs. Although there are very specific attributes of care which are specific to STI management, much of the content is applicable or can be adapted to other fields of medicine.

Apps to help people address their sexual health/STI concerns offer huge potential with respect to reach and information delivery. However, I have shown that the numerous apps currently

available are of highly variable quality, and poorly reflective of burden of disease. A concerning proportion of the apps reviewed provided potentially harmful information and few apps met accepted quality criteria. At present there is no way for the public to easily discern which apps contain trustworthy, accurate information and which ones they should interpret with care. Due to the large expanding volume and diverse nature of contemporary mobile medical apps, regulation would be challenging and potentially detrimental in terms of slowing innovation. Instead, I concur with Boulos et al(205) in that education of consumers is a more feasible option. In England we have an established NHS Choices health apps library(210) but the public needs to be signposted to this . Publicising through general practice, community pharmacy and social media could all help to achieve “brand awareness”. In addition, accreditation by the NHS Choices health apps library needs to become a more transparent process, with information provided as to what criteria the app needs to meet, who is reviewing the app, when the app was entered on to the library and how frequently this is reviewed. However, this would incur costs and this would have to be borne in mind at policy level.

Electronic prescribing provided one of the major challenges that I have needed to overcome with the development of the Chlamydia Online Clinical Care Pathway. As I have described, electronic prescribing in the UK has developed as completely separate entities, both organisationally and legally, in primary and secondary care. Current regulations and legislation are not fit for purpose, lagging behind the rapid development within eHealth, and are potentially impinging innovation within the NHS. At present it is not possible to send an electronic prescription to a community pharmacy unless it is sent via the Electronic Prescription Service which is used within primary care. Although I have reached a solution for the exploratory study, an alternative method will need to be found if a large scale trial is to take place. True patient-centred eSexual Health delivery, and potentially other specialities who work in both a hospital and community setting, would benefit from the ability to prescribe electronically across the primary/secondary care interface. We are currently exploring options

that would enable this to happen. For example there would need to be a statute change in law so that sending an electronic prescription to a community pharmacy is possible outside of the Electronic Prescription Service. Alternatively, a service could be 'bolted on' to the Electronic Prescription Service which would allow eSexual Health Services to use the infrastructure without needing to share a patient's NHS identification number or other identifiable data with the patient demographic service. Another option would be to assess the acceptability to sexual health service patients and people in the community of having their details shared with a national IT system. If it was acceptable to a significant proportion of people, then using the Electronic Prescription Service would be a viable option, although consent would need to be gained from individual patients as part of the service.

ONLINE eSEXUAL HEALTH

eHealth is a nascent field and the lack of evidence-based methodologies for developing online clinical care pathways within the medical literature was striking. Delivering care, which includes a results service, automated online clinical consultation, and an electronic prescription service, meant that this was of paramount importance as this mode of delivery of care is novel and must be delivered robustly. Using a wide remit, informed by guidance for online care where it exists and traditional care where relevant, I have contributed a new framework to assist others in the development of online clinical care pathways. We will take this framework forward to apply to other conditions which are not restricted to eSexual Health. In order for eHealth to reach its full potential, we will increasingly need such frameworks to base the development and delivery of interventions on. I have suggested one set of methods but other approaches need to be developed by other groups.

As part of the eSTI² consortium, I have used robust methodology to create an automated online clinical care pathway for the management of patients diagnosed with genital Chlamydia

trachomatis. The development has been centred on the eClinical Care Pathway Framework which has been applied using the existing evidence base in eSexual Health. This pathway meets current national standards of care and is able to collect the data required for public health surveillance purposes.

There is the potential for this pathway to be expanded to include management of other STIs and genital infections. However, this will be limited in some cases, for example the management of gonorrhoea, by the need for intramuscular treatment. Despite this, patients could still access their results and initial triage via this route, with the eSexual Health Clinic being embedded within a traditional sexual health clinic. This would allow patients the freedom to choose between online management and face-to-face management with the ability to switch between the two as required. In order for this to happen, the eSexual Health Clinic software would need to be interoperable with the traditional clinics IT infrastructure.

Although there is a substantial amount of literature on the evaluation of eHealth interventions, none of these were directly applicable to the evaluation of an online clinical care pathway. I have needed to adopt a continuous iterative evaluation process, with flexibility in terms of methods employed, in forming and implementing the pathway. I have only been able to do this as part of a multi-disciplinary, multi-institutional team with good communication at all stages.

Of concern is whether eSexual Health has the potential to reach hard to reach populations or whether it will actually increase the digital divide. This needs further research and evaluation. Another unanswered question is whether we need an accreditation body for online clinical care pathways. The answer is probably yes, however it needs to be reviewed and implemented rapidly enough so as not to impede innovation and delay patient care.

In summary, eSexual Health offers great potential but it is likely that this will only come to fruition if it has a strong evidence base and is seen as part of the larger service development. I

believe that the Chlamydia Online Clinical Care Pathway is a method that could potentially integrate existing service providers of chlamydia testing. It could provide a single point of access for the results service, triage and management system described, whereby patients who are asymptomatic or minimally symptomatic can access treatment online, and those patients that need to be seen by tertiary services are seen. In addition, it could ensure that all patients are provided with information about chlamydia, the need and a method to initiate partner notification, and health promotion.

Reference List

- (1) GOV.UK. NHS choices: About us. 30-8-2013. 4-1-2015.
Ref Type: Online Source
<http://www.nhs.uk/aboutNHSChoices/aboutnhschoices/Aboutus/Pages/Introduction.aspx>
- (2) British Association for Sexual Health and HIV. 2015. 4-1-2015.
Ref Type: Online Source
<http://www.bashh.org/>
- (3) Family planning association. FPA talking sense about sex: what we do. 2015. 9-4-2015.
Ref Type: Online Source
<http://www.fpa.org.uk/what-we-do>
- (4) eSTI2 Consortium. eSTI2 UKCRC Consortium Application. 2010.
- (5) Car J, Black A, Anandan C, Cresswell K, Pagliari C. The Impact of eHealth on the Quality and Safety of Healthcare. 2008.
- (6) Ofcom. The Communication Market 2014. 2014.
- (7) Boulos MN, Wheeler S, Tavares C, Jones R. How smartphones are changing the face of mobile and participatory healthcare: an overview, with example from eCAALYX. Biomed Eng Online 2011;10:24.
- (8) Ipsos MediaCT. Social Grade. A Classification Tool. 2009. 4-6-2015.
Ref Type: Online Source
https://www.ipsos-mori.com/DownloadPublication/1285_MediaCT_thoughtpiece_Social_Grade_July09_V3_WEB.pdf
- (9) NHS England. Putting Patients First:The NHS England business plan for 2013/4 - 2015/6. 2013.
- (10) NHS Commissioning Board. Everyone Counts: Planning For Patients 2013/14. 2013 Dec.
- (11) Eng T. The e-Health Landscape - a terrain map of emerging information and communication technologies in health and health care. 2004. 23-2-2013.
Ref Type: Online Source
<http://www.rwjf.org/global/404errorpage.jhtml?requestedDocument=/publications/publicationsPdfs/eHealth.pdf>
- (12) Eysenbach G. What is eHealth? J Med Internet Res 2001;3(2):e20.
- (13) Finch TL, Mair FS, May CR. Teledermatology in the UK: lessons in service innovation. Br J Dermatol 2007 Mar;156(3):521-7.

- (14) Schmidt M, Rizvi N, Lee DM, Wood V, Amisano S, Fairley CK. An audit of completeness of clinical histories: before and after introduction of a pro forma. *Int J STD AIDS* 2005 Dec;16(12):822-4.
- (15) Holkar S, Rogstad KE. Introduction of a proforma in the management of under age attendees at a genitourinary clinic. *Int J STD AIDS* 2005 Apr;16(4):278-80.
- (16) Nanthakumaran H, Sullivan AK, Boag FC. An audit of emergency contraception: a look at patient characteristics and the effects of a consultation proforma. *Int J STD AIDS* 1998 Jan;9(1):48-50.
- (17) Abu-Rajab K, Butt A. Introduction of a proforma in the management of under-age attendees at a genitourinary clinic. *Int J STD AIDS* 2006 Jan;17(1):71.
- (18) Hayrinen K, Saranto K, Nykanen P. Definition, structure, content, use and impacts of electronic health records: a review of the research literature. *Int J Med Inform* 2008 May;77(5):291-304.
- (19) Berlin A, Sorani M, Sim I. A taxonomic description of computer-based clinical decision support systems. *J Biomed Inform* 2006 Dec;39(6):656-67.
- (20) Bright TJ, Wong A, Dhurjati R, Bristow E, Bastian L, Coeytaux RR, et al. Effect of clinical decision-support systems: a systematic review. *Ann Intern Med* 2012 Jul 3;157(1):29-43.
- (21) Chi CL, Street WN, Ward MM. Building a hospital referral expert system with a Prediction and Optimization-Based Decision Support System algorithm. *J Biomed Inform* 2008 Apr;41(2):371-86.
- (22) Ali MK, Shah S, Tandon N. Review of electronic decision-support tools for diabetes care: a viable option for low- and middle-income countries? *J Diabetes Sci Technol* 2011 May;5(3):553-70.
- (23) Ebrahimi V, Riou C, Seroussi B, Bouaud J, Dubois S, Falcoff H, et al. Design of a decision support system for chronic diseases coupling generic therapeutic algorithms with guideline-based specific rules. *Stud Health Technol Inform* 2006;124:483-8.
- (24) Eibling D. Making us smart: why the design of clinical decision support systems is so critical. *Laryngoscope* 2008 Dec;118(12):2121-4.
- (25) Fairley CK. Using information technology to control STIs. *Sex Transm Infect* 2011 Dec;87 Suppl 2:ii25-ii27.
- (26) Forsstrom J, Nuutila P, Irjala K. Using the ID3 algorithm to find discrepant diagnoses from laboratory databases of thyroid patients. *Med Decis Making* 1991 Jul;11(3):171-5.
- (27) Friedlin J, Dexter PR, Overhage JM. Details of a successful clinical decision support system. *AMIA Annu Symp Proc* 2007;254-8.
- (28) Garg AX, Adhikari NK, McDonald H, Rosas-Arellano MP, Devereaux PJ, Beyene J, et al. Effects of computerized clinical decision support systems on practitioner performance and patient outcomes: a systematic review. *JAMA* 2005 Mar 9;293(10):1223-38.

- (29) Haynes RB, Wilczynski NL. Effects of computerized clinical decision support systems on practitioner performance and patient outcomes: methods of a decision-maker-researcher partnership systematic review. *Implement Sci* 2010;5:12.
- (30) Hemens BJ, Holbrook A, Tonkin M, Mackay JA, Weise-Kelly L, Navarro T, et al. Computerized clinical decision support systems for drug prescribing and management: a decision-maker-researcher partnership systematic review. *Implement Sci* 2011;6:89.
- (31) Hunt DL, Haynes RB, Hanna SE, Smith K. Effects of computer-based clinical decision support systems on physician performance and patient outcomes: a systematic review. *JAMA* 1998 Oct 21;280(15):1339-46.
- (32) Jacob J. The electronic medical record: decision support and the effective use of clinical guidelines. *Alaska Med* 2003 Apr;45(2):41-6.
- (33) Jeffery R, Iserman E, Haynes RB. Can computerized clinical decision support systems improve diabetes management? A systematic review and meta-analysis. *Diabet Med* 2012 Dec 1.
- (34) Lamy JB, Ellini A, Ebrahimi V, Zucker JD, Falcoff H, Venot A. Use of the C4.5 machine learning algorithm to test a clinical guideline-based decision support system. *Stud Health Technol Inform* 2008;136:223-8.
- (35) Pearson SA, Moxey A, Robertson J, Hains I, Williamson M, Reeve J, et al. Do computerised clinical decision support systems for prescribing change practice? A systematic review of the literature (1990-2007). *BMC Health Serv Res* 2009;9:154.
- (36) Randell R, Mitchell N, Dowding D, Cullum N, Thompson C. Effects of computerized decision support systems on nursing performance and patient outcomes: a systematic review. *J Health Serv Res Policy* 2007 Oct;12(4):242-9.
- (37) Robertson J, Walkom E, Pearson SA, Hains I, Williamsone M, Newby D. The impact of pharmacy computerised clinical decision support on prescribing, clinical and patient outcomes: a systematic review of the literature. *Int J Pharm Pract* 2010 Apr;18(2):69-87.
- (38) Souza NM, Sebaldt RJ, Mackay JA, Prorok JC, Weise-Kelly L, Navarro T, et al. Computerized clinical decision support systems for primary preventive care: a decision-maker-researcher partnership systematic review of effects on process of care and patient outcomes. *Implement Sci* 2011;6:87.
- (39) Black AD, Car J, Pagliari C, Anandan C, Cresswell K, Bokun T, et al. The impact of eHealth on the quality and safety of health care: a systematic overview. *PLoS Med* 2011;8(1):e1000387.
- (40) Richens J, Copas A, Sadiq ST, Kingori P, McCarthy O, Jones V, et al. A randomised controlled trial of computer-assisted interviewing in sexual health clinics. *Sex Transm Infect* 2010 Aug;86(4):310-4.
- (41) Munger MA, Stoddard GJ, Wenner AR, Bachman JW, Jurige JH, Poe L, et al. Safety of prescribing PDE-5 inhibitors via e-medicine vs traditional medicine. *Mayo Clin Proc* 2008 Aug;83(8):890-6.

- (42) Gurol-Urganci I, de JT, Vodopivec-Jamsek V, Car J, Atun R. Mobile phone messaging for communicating results of medical investigations. *Cochrane Database Syst Rev* 2012;6:CD007456.
- (43) Meyer B, Atherton H, Sawmynaden P, Car J. Email for communicating results of diagnostic medical investigations to patients. *Cochrane Database Syst Rev* 2012;8:CD007980.
- (44) Pinnock H, Slack R, Sheikh A. Misconnecting for health: (lack of) advice for professionals on the safe use of mobile phone technology. *Qual Saf Health Care* 2007 Jun;16(3):162-3.
- (45) Department of Health Informatics Directorate. NHS Connecting for Health. 2013. 4-3-2013.
Ref Type: Online Source
<http://www.connectingforhealth.nhs.uk/>
- (46) Estcourt CS. 20-3-2013.
Ref Type: Personal Communication
- (47) Blake H. Innovation in practice: mobile phone technology in patient care. *Br J Community Nurs* 2008 Apr;13(4):160, 162-0, 165.
- (48) Klasnja P, Pratt W. Healthcare in the pocket: mapping the space of mobile-phone health interventions. *J Biomed Inform* 2012 Feb;45(1):184-98.
- (49) van dM, V, van den Hout WB, Bakker MJ, Rabe KF, Sterk PJ, Assendelft WJ, et al. Cost-effectiveness of Internet-based self-management compared with usual care in asthma. *PLoS One* 2011;6(11):e27108.
- (50) Ryan D, Price D, Musgrave SD, Malhotra S, Lee AJ, Ayansina D, et al. Clinical and cost effectiveness of mobile phone supported self monitoring of asthma: multicentre randomised controlled trial. *BMJ* 2012;344:e1756.
- (51) Pinnock H, Slack R, Pagliari C, Price D, Sheikh A. Understanding the potential role of mobile phone-based monitoring on asthma self-management: qualitative study. *Clin Exp Allergy* 2007 May;37(5):794-802.
- (52) Martinez-Perez B, de IT-D, I, Lopez-Coronado M. Mobile health applications for the most prevalent conditions by the world health organization: review and analysis. *J Med Internet Res* 2013;15(6):e120.
- (53) Krishna S, Boren SA, Balas EA. Healthcare via cell phones: a systematic review. *Telemed J E Health* 2009 Apr;15(3):231-40.
- (54) de JT, Gurol-Urganci I, Vodopivec-Jamsek V, Car J, Atun R. Mobile phone messaging for facilitating self-management of long-term illnesses. *Cochrane Database Syst Rev* 2012;12:CD007459.
- (55) Blake H. Mobile phone technology in chronic disease management. *Nurs Stand* 2008 Nov 26;23(12):43-6.

- (56) Baptist AP, Thompson M, Grossman KS, Mohammed L, Sy A, Sanders GM. Social media, text messaging, and email-preferences of asthma patients between 12 and 40 years old. *J Asthma* 2011 Oct;48(8):824-30.
 - (57) Smith M, Dang D, Lee J. E-prescribing: clinical implications for patients with diabetes. *J Diabetes Sci Technol* 2009 Sep;3(5):1215-8.
 - (58) Nirantharakumar K, Marshall T, Hemming K, Narendran P, Coleman JJ. Electronic prescription data is useful in validating discharge diagnostic codes for patients with diabetes. *Diabetic Medicine* 2012;29.
 - (59) Nirantharakumar K, Marshall T, Hemming K, Narendran P, Coleman JJ. Inpatient electronic prescribing data can be used to identify 'lost' discharge codes for diabetes. *Diabetic Medicine* 2012;29(12):e430-e435.
 - (60) Mark DA, Fitzmaurice GJ, Haughey KA, O'Donnell ME, Harty JC. Assessment of the quality of care and financial impact of a virtual renal clinic compared with the traditional outpatient service model. *Int J Clin Pract* 2011 Oct;65(10):1100-7.
 - (61) Austin BS, Gunlock TL, Krishna S, Kramer TC. Computer-aided diabetes education: a synthesis of randomized controlled trials. *AMIA Annu Symp Proc* 2006;51-5.
 - (62) Adaji A, Schattner P, Jones K. The use of information technology to enhance diabetes management in primary care: a literature review. *Inform Prim Care* 2008;16(3):229-37.
 - (63) Boyce N. The Lancet Technology: June, 2012. Maps, apps--and evidence? *Lancet* 2012 Jun 16;379(9833):2231.
 - (64) Muessig KE, Pike EC, Legrand S, Hightow-Weidman LB. Mobile Phone Applications for the Care and Prevention of HIV and Other Sexually Transmitted Diseases: A Review. *J Med Internet Res* 2013;15(1):e1.
 - (65) Harris K, Michie K, Barber J, Winter A. Mobile applications for patients living with HIV. *HIV Medicine* 15[28-29], 1464-2662. 2014.
- Ref Type: Abstract
- (66) Huckvale K, Car M, Morrison C, Car J. Apps for asthma self-management: a systematic assessment of content and tools. *BMC Med* 2012;10:144.
 - (67) Marcano Belisario JS, Huckvale K, Greenfield G, Car J, Gunn LH. Smartphone and tablet self management apps for asthma. *Cochrane Database Syst Rev* 2013;11:CD010013.
 - (68) Neithercott T. Health apps. 12 on-the-go diabetes tools for your smartphone. *Diabetes Forecast* 2013 Jan;66(1):34-7.
 - (69) Eng DS, Lee JM. The promise and peril of mobile health applications for diabetes and endocrinology. *Pediatr Diabetes* 2013 Jun;14(4):231-8.
 - (70) Abroms LC, Padmanabhan N, Thaweethai L, Phillips T. iPhone apps for smoking cessation: a content analysis. *Am J Prev Med* 2011 Mar;40(3):279-85.
 - (71) Choi J, Noh GY, Park DJ. Smoking cessation apps for smartphones: content analysis with the self-determination theory. *J Med Internet Res* 2014;16(2):e44.

- (72) Visser BJ, Korevaar DA, Nolan T. Mobile medical apps: dangers and potential solutions. *J Telemed Telecare* 2013 Mar 21.
- (73) O'Neill S, Brady RR. Colorectal smartphone apps: opportunities and risks. *Colorectal Dis* 2012 Sep;14(9):e530-e534.
- (74) O'Neill S, Brady RR. Clinical involvement and transparency in medical apps; not all apps are equal. *Colorectal Dis* 2013 Jan;15(1):122.
- (75) McCartney M. How do we know whether medical apps work? *BMJ* 2013;346:f1811.
- (76) Buijink AW, Visser BJ, Marshall L. Medical apps for smartphones: lack of evidence undermines quality and safety. *Evid Based Med* 2013 Jun;18(3):90-2.
- (77) Health apps and safety: views from recent sources. *Health Devices* 2012 Oct;41(10):330-1.
- (78) Zanni GR. Medical apps worth having. *Consult Pharm* 2013 May;28(5):322-4.
- (79) Widmeier K. Technology for the field. Mobile apps prove vital to EMS providers. *JEMS* 2012 Nov;37(11):58, 60, 62.
- (80) Walsworth DT. Medical apps: making your mobile device a medical device. *Fam Pract Manag* 2012 May;19(3):10-3.
- (81) Terry M. Medical Apps for Smartphones. *Telemed J E Health* 2010 Jan;16(1):17-22.
- (82) Franko OI. Smartphone apps for orthopaedic surgeons. *Clin Orthop Relat Res* 2011 Jul;469(7):2042-8.
- (83) Burns E. *Information for Health*. Leeds: NHS Executive; 1998.
- (84) Department of Health. *The Power of Information: Putting us all in control of the health and care information we need*. 2012 May 21.
- (85) Department of Health. *Liberating the NHS: An Information Revolution*. 2010.
Ref Type: Online Source
- (86) Department of Health. *NHS Patient Experience Framework*. 2012 Feb 22.
- (87) Department of Health. *Delivering 21st Century IT Support for the NHS - A National Strategic Programme*. London: Department of Health; 2002.
- (88) Department of Health. *Better information, better choices, better health: Putting information at the centre of health*. London: Department of Health; 2004.
- (89) NHS England. *Safer hospitals, safer wards: achieving an integrated digital care record*. 2013 Jul 1.
- (90) NHS England. *NHS Commissioning Board launches library of NHS-reviewed phone apps to keep people healthy*. 12-3-2013. 24-6-2013.
Ref Type: Online Source

<http://www.england.nhs.uk/2013/03/12/nhs-apps/>

- (91) EUnetHTA. EUnetHTA guidelines. 2015. 2-12-0015.
Ref Type: Online Source
<http://www.eunethta.eu/#tab-1-tab>
- (92) Fanta GB, Pretorius L, Erasmus L. An evaluation of eHealth systems implementation frameworks for sustainability in resource constrained environments: at literature review. 2015.
- (93) Holmes KK, Sparling FP, Stamm WE, Piot P, Wasserheit JN, Corey L, et al. Sexually Transmitted Diseases. Fourth Edition ed. McGraw Hill; 2008.
- (94) World Health Organization. Sexually Transmitted Infections (STIs). Fact sheet No 110. 2013 Nov.
- (95) Public Health England. Genitourinary medicine clinic activity dataset (GUMCADv2). 19-12-2013. 19-1-2015.
Ref Type: Online Source
<https://www.gov.uk/genitourinary-medicine-clinic-activity-dataset-gumcadv2>
- (96) Public Health England. CTAD: Chlamydia Testing Activity Dataset. 4-6-2013. 31-12-2013.
Ref Type: Online Source
<http://www.hpa.org.uk/sexualhealth/ctad>
- (97) Public Health England. Health Protection Report: Sexually transmitted infections and chlamydia screening in England, 2013. 14 A.D. Jun 20. Report No.: Vol 8 No. 24.
- (98) Public Health England. Sexually transmitted infections and chlamydia screening in England, 2012. 2013 Jun 7.
- (99) Fairley CK, Williams H, Lee DM, Cummings R. A plea for more research on access to sexual health services. Int J STD AIDS 2007 Feb;18(2):75-6.
- (100) Public Health England. STI diagnoses & rates in England by gender, 2004-2013. 2015. 9-1-2015.
Ref Type: Online Source
https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/340430/Tabl e_1_STI_diagnoses_and_rates_in_England_by_gender.pdf
- (101) Public Health England. What is the NCSP? 2013. 16-12-2013.
Ref Type: Online Source
<http://www.chlamydiascreening.nhs.uk/ys/about.html>
- (102) World Health Organization. Defining sexual health. Report of a technical consultation on sexual health 28-31 January 2002, Geneva. Geneva; 2006.
- (103) Wellings K, Johnson AM. Framing sexual health research: adopting a broader perspective. Lancet 2013 Nov 30;382(9907):1759-62.
- (104) Sonnenberg P, Clifton S, Beddows S, Field N, Soldan K, Tanton C, et al. Prevalence, risk factors, and uptake of interventions for sexually transmitted infections in Britain: findings from the National Surveys of Sexual Attitudes and Lifestyles (Natsal). Lancet 2013 Nov 25.

- (105) Macdowall W, Gibson LJ, Tanton C, Mercer CH, Lewis R, Clifton S, et al. Lifetime prevalence, associated factors, and circumstances of non-volitional sex in women and men in Britain: findings from the third National Survey of Sexual Attitudes and Lifestyles (Natsal-3). *Lancet* 2013 Nov 25.
- (106) Field N, Mercer CH, Sonnenberg P, Tanton C, Clifton S, Mitchell KR, et al. Associations between health and sexual lifestyles in Britain: findings from the third National Survey of Sexual Attitudes and Lifestyles (Natsal-3). *Lancet* 2013 Nov 25.
- (107) Mitchell KR, Mercer CH, Ploubidis GB, Jones KG, Datta J, Field N, et al. Sexual function in Britain: findings from the third National Survey of Sexual Attitudes and Lifestyles (Natsal-3). *Lancet* 2013 Nov 25.
- (108) Mercer CH, Tanton C, Prah P, Erens B, Sonnenberg P, Clifton S, et al. Changes in sexual attitudes and lifestyles in Britain through the life course and over time: findings from the National Surveys of Sexual Attitudes and Lifestyles (Natsal). *Lancet* 2013 Nov 25.
- (109) Department of Health. The national strategy for sexual health and HIV. London; 2001.
- (110) Increased transmission of syphilis in men who have sex with men reported from Brighton and Hove. *Commun Dis Rep CDR Wkly* 2000 May 19;10(20):177, 180.
- (111) Increased transmission of syphilis in Brighton and Greater Manchester among men who have sex with men. *Commun Dis Rep CDR Wkly* 2000 Oct 27;10(43):383, 386.
- (112) Doherty L, Fenton KA, Jones J, Paine TC, Higgins SP, Williams D, et al. Syphilis: old problem, new strategy. *BMJ* 2002 Jul 20;325(7356):153-6.
- (113) Kinghorn GR. Patient access to GUM clinics. *Sex Transm Infect* 2001 Feb;77(1):1-2.
- (114) Foley E, Patel R, Green N, Rowen D. Access to genitourinary medicine clinics in the United Kingdom. *Sex Transm Infect* 2001 Feb;77(1):12-4.
- (115) Djuretic T, Catchpole M, Bingham JS, Robinson A, Hughes G, Kinghorn G. Genitourinary medicine services in the United Kingdom are failing to meet current demand. *Int J STD AIDS* 2001 Sep;12(9):571-2.
- (116) Kinghorn G. A sexual health and HIV strategy for England. *BMJ* 2001 Aug 4;323(7307):243-4.
- (117) Department of Health. The national strategy for sexual health and HIV - Implementation action plan. 2002 Jun 26.
- (118) House of Commons Health Select Committee. Third Report of the Session 2003-2003: Sexual Health 2003. 2003.
- (119) Lavery S, Pugh RN, Joseph AT. The crisis in sexual health and developing genitourinary medicine services: lessons from a primary care trust. *Int J STD AIDS* 2006 Jan;17(1):37-43.
- (120) Sir Liam Donaldson CMO. Improving the Prevention and Treatment of Sexually Transmitted Infections (STIs), including HIV. Department of Health; 2006 Apr 6. Report No.: 6352.

- (121) Medical Foundation for AIDS and Sexual Health. Recommended Sexual Health Standards. 2005 Mar 16.
- (122) Medical Foundation for AIDS and Sexual Health. Recommended Standards for NHS HIV Standards. 2003.
- (123) Department of Health. The NHS in England: The operating framework for 2006/7. 2006 Jan 26.
- (124) Mercer CH, Aicken CR, Estcourt CS, Keane F, Brook G, Rait G, et al. Building the bypass-implications of improved access to sexual healthcare: evidence from surveys of patients attending contrasting genitourinary medicine clinics across England in 2004/2005 and 2009. *Sex Transm Infect* 2012 Feb;88(1):9-15.
- (125) Department of Health. A Framework for Sexual Health Improvement in England. 2013 Mar.
- (126) Waugh MA. 'Through a glass darkly': reflections on genitourinary medicine. *Int J STD AIDS* 1991 Sep;2(5):325-32.
- (127) Sadler KE, Low N, Mercer CH, Sutcliffe LJ, Islam MA, Shafi S, et al. Testing for sexually transmitted infections in general practice: cross-sectional study. *BMC Public Health* 2010;10:667.
- (128) Sutcliffe LJ, Sadler KE, Low N, Cassell JA. Comparing expectations and experiences of care for sexually transmitted infections in general practice: a qualitative study. *Sex Transm Infect* 2011 Mar;87(2):131-5.
- (129) Yung M, Denholm R, Peake J, Hughes G. Distribution and characteristics of sexual health service provision in primary and community care in England. *Int J STD AIDS* 2010 Sep;21(9):650-2.
- (130) French RS, Coope CM, Graham A, Gerressu M, Salisbury C, Stephenson JM. One stop shop versus collaborative integration: what is the best way of delivering sexual health services? *Sex Transm Infect* 2006 Jun;82(3):202-6.
- (131) Department of Health. Summary and conclusions of CMO's Expert Advisory Group on *Chlamydia trachomatis*. 1998.
- (132) Gleave T. Implementing a Chlamydia pilot screening programme. *Nurs Times* 2002 Dec 10;98(50):34-7.
- (133) Adams EJ, Turner KM, Edmunds WJ. The cost effectiveness of opportunistic chlamydia screening in England. *Sex Transm Infect* 2007 Jul;83(4):267-74.
- (134) Low N, Ward H. Focus on Chlamydia. *Sex Transm Infect* 2007 Jul;83(4):251-2.
- (135) Department of Health. Dr Ruth Hussey's Report. 2009.
- (136) House of Commons Committee of Public Accounts. Seventh Report of Session 2009-10. Young people's sexual health: the National Chlamydia Screening Programme. 2010 Jan 18.

- (137) National Chlamydia Screening Programme. NCSP scorecard Q1-4. 2012.
- (138) The Public Health (Venereal Diseases) Regulations July 12th 1916, Her Majesty's Stationary Office (London), (1916).
- (139) Department of Health. The NHS Trusts and Primary Care Trusts (Sexually Transmitted Diseases) Directions 2000. 2000 Sep 8.
- (140) British Association of Sexual Health & HIV. BASHH Groups: National Audit Group. 28-1-2013. 31-12-2013.
- Ref Type: Online Source
http://www.bashh.org/BASHH/BASHH_Groups/National_Audit_Group/BASHH/BASHH_Groups/National_Audit_Group.aspx?hkey=c17918b8-5c72-40bd-981f-632f89e45708
- (141) Public Health England. Sexually Transmitted Infections Annual Data. 17-12-2013. 31-12-2013.
- Ref Type: Online Source
<http://www.hpa.org.uk/Topics/InfectiousDiseases/InfectionsAZ/STIs/STIsAnnualDataTables/>
- (142) Shamos SJ, Mettenbrink CJ, Subiadur JA, Mitchell BL, Rietmeijer CA. Evaluation of a testing-only "express" visit option to enhance efficiency in a busy STI clinic. *Sex Transm Dis* 2008 Apr;35(4):336-40.
- (143) Knight V, Ryder N, Guy R, Lu H, Wand H, McNulty A. New xpress sexually transmissible infection screening clinic improves patient journey and clinic capacity at a large sexual health clinic. *Sex Transm Dis* 2013 Jan;40(1):75-80.
- (144) Martin L, Knight V, Ryder N, Lu H, Read PJ, McNulty A. Client feedback and satisfaction with an express sexually transmissible infection screening service at an inner-city sexual health center. *Sex Transm Dis* 2013 Jan;40(1):70-4.
- (145) Curry SJ. eHealth research and healthcare delivery beyond intervention effectiveness. *Am J Prev Med* 2007 May;32(5 Suppl):S127-S130.
- (146) Levine D, Woodruff AJ, Mocello AR, Lebrija J, Klausner JD. inSPOT: the first online STD partner notification system using electronic postcards. *PLoS Med* 2008 Oct 21;5(10):e213.
- (147) Kerani RP, Fleming M, DeYoung B, Golden MR. A randomized, controlled trial of inSPOT and patient-delivered partner therapy for gonorrhea and chlamydial infection among men who have sex with men. *Sex Transm Dis* 2011 Oct;38(10):941-6.
- (148) Bilardi JE, Fairley CK, Hopkins CA, Hocking JS, Sze JK, Chen MY. Let Them Know: evaluation of an online partner notification service for chlamydia that offers E-mail and SMS messaging. *Sex Transm Dis* 2010 Sep;37(9):563-5.
- (149) Hewett PC, Mensch BS, Ribeiro MC, Jones HE, Lippman SA, Montgomery MR, et al. Using sexually transmitted infection biomarkers to validate reporting of sexual behavior within a randomized, experimental evaluation of interviewing methods. *Am J Epidemiol* 2008 Jul 15;168(2):202-11.

- (150) Johnson AM, Copas AJ, Erens B, Mandalia S, Fenton K, Korolessis C, et al. Effect of computer-assisted self-interviews on reporting of sexual HIV risk behaviours in a general population sample: a methodological experiment. *AIDS* 2001;(15):111-5.
- (151) Kurth AE, Martin DP, Golden MR, Weiss NS, Heagerty PJ, Spielberg F, et al. A comparison between audio computer-assisted self-interviews and clinician interviews for obtaining the sexual history. *Sex Transm Dis* 2004 Dec;31(12):719-26.
- (152) Tideman RL, Chen MY, Pitts MK, Ginige S, Slaney M, Fairley CK. A randomised controlled trial comparing computer-assisted with face-to-face sexual history taking in a clinical setting. *Sex Transm Infect* 2007 Feb;83(1):52-6.
- (153) Ghanem KG, Hutton HE, Zenilman JM, Zimba R, Erbelding EJ. Audio computer assisted self interview and face to face interview modes in assessing response bias among STD clinic patients. *Sex Transm Infect* 2005 Oct;81(5):421-5.
- (154) Copas AJ, Wellings K, Erens B, Mercer CH, McManus S, Fenton KA, et al. The accuracy of reported sensitive sexual behaviour in Britain: exploring the extent of change 1990-2000. *Sex Transm Infect* 2002;(78):26-30.
- (155) Kissinger P, Rice J, Farley T, Trim S, Jewitt K, Margavio V, et al. Application of computer-assisted interviews to sexual behavior research. *Am J Epidemiol* 1999 May 15;149(10):950-4.
- (156) Fairley CK, Sze JK, Vodstrcil LA, Chen MY. Computer-assisted self interviewing in sexual health clinics. *Sex Transm Dis* 2010 Nov;37(11):665-8.
- (157) Rogers SM, Willis G, Al-Tayyib A, Villarroel MA, Turner CF, Ganapathi L, et al. Audio computer assisted interviewing to measure HIV risk behaviours in a clinic population. *Sex Transm Infect* 2005 Dec;81(6):501-7.
- (158) Langhaug LF, Sherr L, Cowan FM. How to improve the validity of sexual behaviour reporting: systematic review of questionnaire delivery modes in developing countries. *Trop Med Int Health* 2010 Mar;15(3):362-81.
- (159) Tideman RL, Pitts MK, Fairley CK. Client acceptability of the use of computers in a sexual health clinic. *Int J STD AIDS* 2006 Feb;17(2):121-3.
- (160) Shoveller J, Knight R, Davis W, Gilbert M, Ogilvie G. Online sexual health services: examining youth's perspectives. *Can J Public Health* 2012 Jan;103(1):14-8.
- (161) Superdrug Online Doctor. Sexual Health. 2015.
Ref Type: Online Source
<https://onlinedoctor.superdrug.com/sexual-health-clinic.html>
- (162) BBC News. Concern over online gonorrhoea treatment. 1-3-2015. 5-4-2015.
Ref Type: Online Source
<http://www.bbc.co.uk/news/health-31649099>
- (163) Sullivan V. Online treatment for sex infections threatens public health. 2015. 9-4-2015.
Ref Type: Online Source

- (164) Woodhall SC, Sile B, Talebi A, Nardone A, Baraitser P. Internet testing for Chlamydia trachomatis in England, 2006 to 2010. *BMC Public Health* 2012;12:1095.
- (165) Estcourt CS. Testing and treating STIs in hard to reach populations. 15 A.D. Jun 3; 2015.
- (166) Schackman BR, Dastur Z, Ni Q, Callahan MA, Berger J, Rubin DS. Sexually active HIV-positive patients frequently report never using condoms in audio computer-assisted self-interviews conducted at routine clinical visits. *AIDS Patient Care STDS* 2008 Feb;22(2):123-9.
- (167) Williams ML, Freeman RC, Bowen AM, Zhao Z, Elwood WN, Gordon C, et al. A comparison of the reliability of self-reported drug use and sexual behaviors using computer-assisted versus face-to-face interviewing. *AIDS Educ Prev* 2000 Jun;12(3):199-213.
- (168) Erens B, Phelps A, Clifton S, Mercer CH, Tanton C, Hussey D, et al. Methodology of the third British National Survey of Sexual Attitudes and Lifestyles (Natsal-3). *Sex Transm Infect* 2013 Nov 25.
- (169) Aicken CR, Gray M, Clifton S, Tanton C, Field N, Sonnenberg P, et al. Improving Questions on Sexual Partnerships: Lessons Learned from Cognitive Interviews for Britain's Third National Survey of Sexual Attitudes and Lifestyles ("Natsal-3"). *Arch Sex Behav* 2012 Jun 14.
- (170) Woodward CL, Roedling S, Edwards SG, Armstrong A, Richens J. Computer-assisted survey of attitudes to HIV and sexually transmissible infection partner notification in HIV-positive men who have sex with men. *Sex Health* 2010 Dec;7(4):460-2.
- (171) van der Elst EM, Okuku HS, Nakamya P, Muhaari A, Davies A, McClelland RS, et al. Is audio computer-assisted self-interview (ACASI) useful in risk behaviour assessment of female and male sex workers, Mombasa, Kenya? *PLoS One* 2009;4(5):e5340.
- (172) Morrison-Beedy D, Carey MP, Tu X. Accuracy of audio computer-assisted self-interviewing (ACASI) and self-administered questionnaires for the assessment of sexual behavior. *AIDS Behav* 2006 Sep;10(5):541-52.
- (173) Dolezal C, Marhefka SL, Santamaria EK, Leu CS, Brackis-Cott E, Mellins CA. A comparison of audio computer-assisted self-interviews to face-to-face interviews of sexual behavior among perinatally HIV-exposed youth. *Arch Sex Behav* 2012 Apr;41(2):401-10.
- (174) Scoular A, Duncan B, Hart G. "That sort of place...where filthy men go...": a qualitative study of women's perceptions of genitourinary medicine services. *Sex Transm Infect* 2001 Oct;77(5):340-3.
- (175) Thomas N, Murray E, Rogstad KE. Confidentiality is essential if young people are to access sexual health services. *Int J STD AIDS* 2006 Aug;17(8):525-9.

- (176) Fuller S, Aicken C, Sutcliffe L, stcourt CS, Gk, zidou V, et al. What are young people's perceptions of using electronic self-tests for STIs linked to mobile technology for diagnosis and care (eSTI²)? STI & AIDS World Congress, Vienna . 2013.

Ref Type: Abstract

- (177) Ryder N, McNulty AM. Confidentiality and access to sexual health services. *Sex Health* 2009 Jun;6(2):153-5.
- (178) Poulton M. Patient confidentiality in sexual health services and electronic patient records. *Sex Transm Infect* 2013 Mar;89(2):90.
- (179) Jaya, Hindin MJ, Ahmed S. Differences in young people's reports of sexual behaviors according to interview methodology: a randomized trial in India. *Am J Public Health* 2008 Jan;98(1):169-74.
- (180) Weston R, Dabis R, Ross JD. Measuring patient satisfaction in sexually transmitted infection clinics: a systematic review. *Sex Transm Infect* 2009 Oct;85(6):459-67.
- (181) Gkatzidou V, Hone K, Sutcliffe LJ, Gibbs J, Sadiq ST, Sczcepura A, et al. User interface design for mobile-based sexual health interventions for young people: Design recommendations from a qualitative study on an online Chlamydia clinical care pathway. 2015.

Ref Type: Unpublished Work

- (182) Lim EJ, Haar J, Morgan J. Can text messaging results reduce time to treatment of Chlamydia trachomatis? *Sex Transm Infect* 2008 Dec;84(7):563-4.
- (183) Lorimer K, McDaid L. Young Men's Views Toward the Barriers and Facilitators of Internet-Based Chlamydia Trachomatis Screening: Qualitative Study. *J Med Internet Res* 2013;15(12):e265.
- (184) Gaydos CA, Barnes M, Aumakhan B, Quinn N, Wright C, Agreda P, et al. Chlamydia trachomatis age-specific prevalence in women who used an internet-based self-screening program compared to women who were screened in family planning clinics. *Sex Transm Dis* 2011 Feb;38(2):74-8.
- (185) Gaydos CA, Rizzo-Price PA, Barnes M, Dwyer K, Wood BJ, Hogan MT. The use of focus groups to design an internet-based program for chlamydia screening with self-administered vaginal swabs: what women want. *Sex Health* 2006 Dec;3(4):209-15.
- (186) Gaydos CA, Dwyer K, Barnes M, Rizzo-Price PA, Wood BJ, Flemming T, et al. Internet-based screening for Chlamydia trachomatis to reach non-clinic populations with mailed self-administered vaginal swabs. *Sex Transm Dis* 2006 Jul;33(7):451-7.
- (187) Gaydos CA, Barnes M, Aumakhan B, Quinn N, Agreda P, Whittle P, et al. Can e-technology through the Internet be used as a new tool to address the Chlamydia trachomatis epidemic by home sampling and vaginal swabs? *Sex Transm Dis* 2009 Sep;36(9):577-80.
- (188) Spielberg F, Levy V, Lensing S, Chattopadhyay I, Venkatasubramanian L, Acevedo N, et al. Fully integrated e-services for prevention, diagnosis, and treatment of sexually transmitted infections: results of a 4-county study in California. *Am J Public Health* 2014 Dec;104(12):2313-20.

- (189) eSTI2 Consortium. eSTI2 Project Plan_v2. 2011.
- (190) Bailey JV, Pavlou M, Copas A, McCarthy O, Carswell K, Rait G, et al. The Sexunzipped trial: optimizing the design of online randomized controlled trials. *J Med Internet Res* 2013;15(12):e278.
- (191) Family planning association. FPA talking sense about sex: what we do. 2015.
Ref Type: Online Source
<http://www.fpa.org.uk/what-we-do>
- (192) Expert Health Limited. Dr Thom. 2015. 5-4-2015.
Ref Type: Online Source
<https://www.drthom.com/>
- (193) Department of Health. GPs to 'prescribe' apps for patients. 22-2-2012. 19-11-2014.
Ref Type: Online Source
<https://www.gov.uk/government/news/gps-to-prescribe-apps-for-patients>
- (194) Wolf JA, Moreau JF, Akilov O, Patton T, English JC, III, Ho J, et al. Diagnostic inaccuracy of smartphone applications for melanoma detection. *JAMA Dermatol* 2013 Apr;149(4):422-6.
- (195) Weaver ER, Horyniak DR, Jenkinson R, Dietze P, Lim MS. "Let's get Wasted!" and Other Apps: Characteristics, Acceptability, and Use of Alcohol-Related Smartphone Applications. *JMIR Mhealth Uhealth* 2013;1(1):e9.
- (196) West JH, Hall PC, Hanson CL, Barnes MD, Giraud-Carrier C, Barrett J. There's an app for that: content analysis of paid health and fitness apps. *J Med Internet Res* 2012;14(3):e72.
- (197) Thompson MA, Misra S. Oncology Smartphone applications: perspectives from a researcher/community-based hematologist/oncologist and a physician reviewer of medical apps. *Oncology (Williston Park)* 2012 Mar;26(3):231, 236, 238-1, 236, 239.
- (198) Ritchie A. 10 apps physicians recommend to their patients. *Med Econ* 2013 Aug 10;90(15):42.
- (199) Harrison AM, Goozee R. Psych-related iPhone apps. *J Ment Health* 2014 Feb;23(1):48-50.
- (200) Pandey A, Hasan S, Dubey D, Sarangi S. Smartphone apps as a source of cancer information: changing trends in health information-seeking behavior. *J Cancer Educ* 2013 Mar;28(1):138-42.
- (201) Arnhold M, Quade M, Kirch W. Mobile applications for diabetics: a systematic review and expert-based usability evaluation considering the special requirements of diabetes patients age 50 years or older. *J Med Internet Res* 2014;16(4):e104.
- (202) NHS Choices. Health Apps Library. 2013. 24-6-2013.
Ref Type: Online Source
<http://apps.nhs.uk/>
- (203) NHS Choices health apps library. 2014. 20-11-2014.

Ref Type: Online Source

<http://apps.nhs.uk/>

- (204) Gkatzidou V, Hone K, Gibbs J, Sutcliffe L, Sadiq ST, Sonnenberg P, et al. A user-centered approach to inform the design of a mobile application for STI diagnosis and management. 2013.
- (205) Boulos MN, Brewer AC, Karimkhani C, Buller DB, Dellavalle RP. Mobile medical and health apps: state of the art, concerns, regulatory control and certification. Online J Public Health Inform 2014;5(3):229.
- (206) Medicines and Healthcare Products Regulatory Agency. Medicines & Medical Devices Regulation: what you need to know. 2008. 8-1-2015.

Ref Type: Online Source

<http://www.mhra.gov.uk/home/groups/comms-ic/documents/websiteresources/con2031677.pdf>

- (207) Abroms LC, Lee WJ, Bontemps-Jones J, Ramani R, Mellerson J. A content analysis of popular smartphone apps for smoking cessation. Am J Prev Med 2013 Dec;45(6):732-6.
- (208) Estcourt C, Evans DE. Core learning outcomes in sexual and reproductive health and HIV for medical undergraduates: improving skills of future providers. Sex Transm Infect 2005;81(440).
- (209) Lewis TL. A systematic self-certification model for mobile medical apps. J Med Internet Res 2013;15(4):e89.
- (210) NHS Choices. Health apps library: Sexual health. 2014. 22-11-2014.

Ref Type: Online Source

<http://apps.nhs.uk/tags/sexual-health/>

- (211) Pimenta JM, Catchpole M, Rogers PA, Hopwood J, Randall S, Mallinson H, et al. Opportunistic screening for genital chlamydial infection. II: prevalence among healthcare attenders, outcome, and evaluation of positive cases. Sex Transm Infect 2003 Feb;79(1):22-7.
- (212) Dominiak-Felden G, Cohet C, Atrux-Tallau S, Gilet H, Tristram A, Fiander A. Impact of human papillomavirus-related genital diseases on quality of life and psychosocial wellbeing: results of an observational, health-related quality of life study in the UK. BMC Public Health 2013;13:1065.
- (213) Merin A, Pachankis JE. The psychological impact of genital herpes stigma. J Health Psychol 2011 Jan;16(1):80-90.
- (214) Mark H, Gilbert L, Nanda J. Psychosocial well-being and quality of life among women newly diagnosed with genital herpes. J Obstet Gynecol Neonatal Nurs 2009 May;38(3):320-6.
- (215) Green J. Psychosocial issues in genital herpes management. Herpes 2004 Dec;11(3):60-2.
- (216) Brentjens MH, Yeung-Yue KA, Lee PC, Tying SK. Recurrent genital herpes treatments and their impact on quality of life. Pharmacoeconomics 2003;21(12):853-63.

(217) Health on the Net. The Health on the Net Foundation Code of Conduct for medical and health Web sites (HONcode). 25-8-2014. 8-12-2014.

Ref Type: Online Source

<http://www.hon.ch/HONcode/>

(218) Bender JL, Yue RY, To MJ, Deacken L, Jadad AR. A lot of action, but not in the right direction: systematic review and content analysis of smartphone applications for the prevention, detection, and management of cancer. *J Med Internet Res* 2013;15(12):e287.

(219) Sunyaev A, Dehling T, Taylor PL, Mandl KD. Availability and quality of mobile health app privacy policies. *J Am Med Inform Assoc* 2014 Aug 21.

(220) Powell AC, Landman AB, Bates DW. In search of a few good apps. *JAMA* 2014 May 14;311(18):1851-2.

(221) Medicines and Healthcare Products Regulatory Agency. Medical Devices Classification. 16-8-2013. 8-1-2015.

Ref Type: Online Source

<http://www.mhra.gov.uk/Howweregulate/Devices/Classification/index.htm>

(222) Shuren J. The FDA's role in the development of medical mobile applications. *Clin Pharmacol Ther* 2014 May;95(5):485-8.

(223) US Food and Drug Administration. Mobile medical apps. 6-4-2014. 16-12-2014.

Ref Type: Online Source

<http://www.fda.gov/MedicalDevices/ProductsandMedicalProcedures/ConnectedHealth/MobileMedicalApplications/ucm255978.htm>

(224) Misra S. Happitque's recent setback shows that health app certification is a flawed proposition. 2014. 14-12-2014.

Ref Type: Online Source

<http://www.imedicalapps.com/2014/01/happtiques-setback-future-app-certification/>

(225) Chan SR, Misra S. Certification of mobile apps for health care. *JAMA* 2014 Sep 17;312(11):1155-6.

(226) Thompson BM, Brodsky I. Should the FDA regulate mobile medical apps? *BMJ* 2013;347:f5211.

(227) Charani E, Castro-Sanchez E, Moore LS, Holmes A. Do smartphone applications in healthcare require a governance and legal framework? It depends on the application! *BMC Med* 2014;12:29.

(228) Fuller SS, Sutcliffe LJ, Estcourt CS, Gkatzidou V, Hone K, Sonnenberg P, et al. What are young people's perceptions of using electronic self-tests for STIs linked to mobile technology for diagnosis and care (eSTI²)? *Sex Transm Infect.* 89[(Suppl 1)], A69. 2013.

Ref Type: Abstract

(229) Helsper E. Digital Natives and ostrich tactics? The possible implications of labelling young people as digital experts. 2008.

Ref Type: Online Source

http://www.beyondcurrenthorizons.org.uk/wp-content/uploads/final_helsper_digitalnativesostrichtactics_20081201_jb.pdf

- (230) Swendeman D, Rotheram-Borus MJ. Innovation in sexually transmitted disease and HIV prevention: internet and mobile phone delivery vehicles for global diffusion. *Curr Opin Psychiatry* 2010 Mar;23(2):139-44.
- (231) Nolan T. A smarter way to practise. *BMJ* 2011;342:d1124.
- (232) Chomutare T, Fernandez-Luque L, Arsand E, Hartvigsen G. Features of mobile diabetes applications: review of the literature and analysis of current applications compared against evidence-based guidelines. *J Med Internet Res* 2011;13(3):e65.
- (233) Derbyshire E, Dancey D. Smartphone Medical Applications for Women's Health: What Is the Evidence-Base and Feedback? *Int J Telemed Appl* 2013;2013:782074.
- (234) A reality checkpoint for mobile health: three challenges to overcome. *PLoS Med* 2013;10(2):e1001395.
- (235) Tomlinson M, Rotheram-Borus MJ, Swartz L, Tsai AC. Scaling up mHealth: where is the evidence? *PLoS Med* 2013;10(2):e1001382.
- (236) Kaushal R, Shojania KG, Bates DW. Effects of computerized physician order entry and clinical decision support systems on medication safety: a systematic review. *Arch Intern Med* 2003 Jun 23;163(12):1409-16.
- (237) Kawamoto K, Houlihan CA, Balas EA, Lobach DF. Improving clinical practice using clinical decision support systems: a systematic review of trials to identify features critical to success. *BMJ* 2005 Apr 2;330(7494):765.
- (238) Health and Social Care Information Centre. Spine transition update - posted Friday 29th August. 2015. 20-4-2015.
Ref Type: Online Source
<http://systems.hscic.gov.uk/spine/transition>
- (239) Health and Social Care Information Centre. Electronic Prescription Service. 2013. 29-5-2013.
Ref Type: Online Source
<http://systems.hscic.gov.uk/eps>
- (240) Health and Social Care Information Centre. Spine 2 Programme. Information Pack for Suppliers of Systems using Spine Services. 2013 Apr 11.
- (241) Health and Social Care Information Centre. Electronic Prescription Service - News. 2015. 3-5-2015.
Ref Type: Online Source
<http://systems.hscic.gov.uk/eps/news/index.html>
- (242) Khoja S, Durrani H, Scott RE, Sajwani A, Piryani U. Conceptual framework for development of comprehensive e-health evaluation tool. *Telemed J E Health* 2013 Jan;19(1):48-53.

- (243) Department of Health. Building the Information Core: Implementing the NHS Plan. London: Department of Health; 2001.
- (244) Chartered Institute for IT, Department of Health. Keeping your online health and social care records safe and secure. 2012.
- (245) Cross M. Problems with computerising patients' records are "as serious as ever," says MP. BMJ 2009;(338):b337.
- (246) Greenhalgh T, Keen J. England's national programme for IT. BMJ 2013;346:f4130.
- (247) Pagliari C, Singleton P, Detmer DE. NHS national programme for IT. Time for a reality check of NPfIT's problems. BMJ 2009;338:b643.
- (248) Cross M. There IT goes again. BMJ (Online) 2011;343(7824).
- (249) Cornford T, Savage I, Jani Y, Franklin BD, Barber N, Slee A, et al. Learning lessons from electronic prescribing implementations in secondary care. Studies in Health Technology and Informatics 2010;160(PART 1):233-7.
- (250) Department of Health. Reconfiguring the Department of Health's Arm's Length Bodies. 2004.
- (251) legislation.gov.uk. Health and Social Care Act 2012. 2012.
Ref Type: Statute
- (252) Shortliffe EH. Strategic action in health information technology: why the obvious has taken so long. Health Aff (Millwood) 2005 Sep;24(5):1222-33.
- (253) Dornan T, Ashcroft D, Heathfield H, Lewis P, Miles J, Taylor D, et al. An in depth investigation into causes of prescribing errors by foundation trainees in relation to their medical education. EQUIP study. 2009.
- (254) Bignardi GE, Hamson C, Chalmers A. Can we use electronic prescribing to reduce prescription errors for antibiotics? J Infect 2010 Nov;61(5):427-8.
- (255) Bignardi GE. Reducing prescription errors. Lancet 2010;375(9713).
- (256) Weetman T, Aronson J, Maxwell S. Reducing prescription errors. Lancet 2010 Feb 6;375(9713):461-2.
- (257) Coombes I, Reid C, Stowasser D, Duigiud M, Bedford G, Mitchell C. Reducing prescription errors. Lancet 2010 Feb 6;375(9713):462.
- (258) Motulsky A, Lamothe L, Sicotte C. Impacts of second-generation electronic prescriptions on the medication management process in primary care: A systematic review. Int J Med Inform 2013 Feb 18.
- (259) Greenhalgh T, Peacock R. Effectiveness and efficiency of search methods in systematic reviews of complex evidence: audit of primary sources. BMJ 2005 Nov 5;331(7524):1064-5.

- (260) British National Formulary. BNF November 2013. BMJ Group & Pharmaceutical Press; 2013.
 - (261) General Medical Council. Good practice in prescribing and managing medicines and devices. 2013.
 - (262) Her Majesty's Stationary Office (London). The Prescription Only Medicines (Human Use) (Electronic Communications) Order 2001. 2001.
 - (263) Her Majesty's Stationary Office (London). The Prescription Only Medicines (Human Use) Order 1997. 1997.
 - (264) Her Majesty's Stationary Office (London). NHS (Pharmaceuticals and Local Pharmaceutical Services) Regulations 2013. 2013.
- Ref Type: Statute
- (265) NHS Prescription Services. Current and Out of Date Prescription Form Versions. 2013. 30-12-2013.
- Ref Type: Online Source
- http://www.nhsbsa.nhs.uk/PrescriptionServices/Documents/PrescriptionServices/Current_and_Out_of_Date_Rx_Form_V4_Revised_June_2013.pdf
- (266) NHS Information Governance. Guidelines on use of encryption to protect person identifiable and sensitive information. 2008. NHS Connecting for Health. 4-3-2013.
- Ref Type: Online Source
- <http://www.connectingforhealth.nhs.uk/systemsandservices/infogov/security/encryptionguide.pdf>
- (267) Pharmaceutical Services Negotiating Committee. Valid Prescription Forms. 2013. 29-5-2013.
- Ref Type: Online Source
- http://www.psn.org.uk/pages/valid_prescription_forms.html
- (268) Department of Health. EL (91) 127. Responsibility for prescribing between hospitals and GPs. 1991.
 - (269) NHS Prescription Services. Overprint Specification for Hospital Unit FP10SS Forms. 1-4-2013. 30-12-2013.
- Ref Type: Online Source
- http://www.nhsbsa.nhs.uk/PrescriptionServices/Documents/PrescriptionServices/Overprint_Specification_for_Hospital_Unit_FP10SS_April_13.pdf
- (270) NHS Connecting for health. EPS Release 2. Business Process Guidance for Initial Implementers. 2009 Apr.
 - (271) NHS Connecting for Health. Electronic prescribing in hospitals; Challenges and lessons learned. 2009.
 - (272) Cresswell K, Coleman J, Slee A, Williams R, Sheikh A. Investigating and learning lessons from early experiences of implementing ePrescribing systems into NHS hospitals: a questionnaire study. PLoS One 2013;8(1):e53369.

- (273) Ahmed Z, McLeod MC, Barber N, Jacklin A, Franklin BD. The use and functionality of electronic prescribing systems in english acute NHS trusts: a cross-sectional survey. PLoS One 2013;8(11):e80378.
- (274) Health and Social Care Information Centre. Electronic Prescription Service. 2015. 21-5-2015.
Ref Type: Online Source
<http://systems.hscic.gov.uk/eps>
- (275) Health and Social Care Information Centre. Release 1: What is EPS Release 1. 2013. 3-10-2013.
Ref Type: Online Source
<http://systems.hscic.gov.uk/eps/library/fags/release1>
- (276) Fernando TJ, Nguyen DD, Baraff LJ. Effect of electronically delivered prescriptions on compliance and pharmacy wait time among emergency department patients. Academic Emergency Medicine 2012;19(1):102-5.
- (277) Ax F, Ekedahl A. Electronically transmitted prescriptions not picked up at pharmacies in Sweden. Research in Social and Administrative Pharmacy 2010;6(1):70-7.
- (278) Fischer MA, Stedman MR, Lii J, Vogeli C, Shrank WH, Brookhart MA, et al. Primary medication non-adherence: Analysis of 195,930 electronic prescriptions. Journal of General Internal Medicine 2010;25(4):284-90.
- (279) Ma A, Chen DM, Chau FM, Saberi P. Improving adherence and clinical outcomes through an HIV pharmacist's interventions. AIDS Care - Psychological and Socio-Medical Aspects of AIDS/HIV 2010;22(10):1189-94.
- (280) Harbig P, Barat I, Lund P, Damsgaard EM. Instantaneous detection of nonadherence: Quality, strength, and weakness of an electronic prescription database. Pharmacoepidemiology and Drug Safety 2012;21(3):323-8.
- (281) Sue Eaton. PCT lead commissioner for primary care who oversaw the implementation of the new community pharmacy contract and subsequent roll out of EPS. 21-10-2013.
Ref Type: Personal Communication
- (282) Wikipedia. Smartphone. 30-12-2013. 31-12-2013.
Ref Type: Online Source
<http://en.wikipedia.org/wiki/Smartphone>
- (283) Health and Social Care Information Centre. Statistics and progress. 2015.
Ref Type: Online Source
<http://systems.hscic.gov.uk/eps/stats>
- (284) Health and Social Care Information Centre. Registration Authorities and Smartcards. Information for Patients and Public. 2015. 4-6-2015.
Ref Type: Online Source
<http://systems.hscic.gov.uk/rasmartcards/patients>
- (285) Health and Social Care Information Centre. Generating and signing electronic prescriptions. 2015. 20-4-2015.
Ref Type: Online Source

<http://systems.hscic.gov.uk/eps/library/0112.pdf>

- (286) Health and Social Care Information Centre. Spine transition update - posted Friday 29th August. 2014. 20-4-2015.

Ref Type: Online Source

<http://systems.hscic.gov.uk/spine/transition>

- (287) NHS Connecting for health. Prescribing Systems Compliance Specification. 2012. 13-10-2013.

Ref Type: Online Source

http://systems.hscic.gov.uk/eps/library/compliance/presc_22.pdf

- (288) National Information Governance Board for Health and Social Care. The Care Record Guarantee; Our Guarantee for NHS Care Records in England. 2011. 10-10-2013.

Ref Type: Online Source

<http://systems.hscic.gov.uk/rasmartcards/documents/crg.pdf>

- (289) Abramson EL, Malhotra S, Fischer K, Edwards A, Pfoh ER, Osorio SN, et al. Transitioning between electronic health records: Effects on ambulatory prescribing safety. *Journal of General Internal Medicine* 2011;26(8):868-74.

- (290) Abdel-Qader D, Harper L, Cantrill J, Tully M. Characterising pharmacists' interventions in an electronic prescribing system at hospital discharge. *International Journal of Pharmacy Practice* 2009;17(S2):B16-B17.

- (291) Health and Social Care Information Centre. A new way to get your medicines and appliances. 2014. 20-4-2015.

Ref Type: Online Source

<http://systems.hscic.gov.uk/eps/library/patientfact.pdf>

- (292) Her Majesty's Stationary Office (London). Medicines Act 1968. 1968.

Ref Type: Statute

<http://www.legislation.gov.uk/ukpga/1968/67/contents>

- (293) NHS Commissioning Board. Commissioning Policy: Defining the Boundaries between NHS and Private Healthcare. 2013 Apr.

- (294) Medicines and Healthcare products Regulatory Agency. Frequently asked questions: Patient Specific Directions. 29-4-2013. 30-12-2013.

Ref Type: Online Source

<http://www.mhra.gov.uk/PrintPreview/DefaultSplashPP/CON263943?ResultCount=10&DynamicListQuery=&DynamicListSortBy=xCreationDate&DynamicListSortOrder=Desc&DynamicListTitle=&PageNumber=1&Title=Frequently%20asked%20questions%3a%20Patient%20Specific%20Directions>

- (295) British Medical Association. Patient Group Directions and Patient Specific Directions in general practice. 2010. 30-12-2013.

Ref Type: Online Source

<http://bma.org.uk/practical-support-at-work/gp-practices/prescribing>

- (296) Estcourt C, Sutcliffe L, Cassell J, Mercer CH, Copas A, James L, et al. Can we improve partner notification rates through expedited partner therapy in the UK? Findings from

an exploratory trial of Accelerated Partner Therapy (APT). *Sex Transm Infect* 2012 Feb;88(1):21-6.

(297) NHS England. Strategic Systems and Technology. 2015.

Ref Type: Online Source

<http://www.england.nhs.uk/ourwork/tsd/sst/>

(298) BASHH Clinical Effectiveness Group. 2013 UK national guideline for consultations requiring sexual history taking. 2013.

(299) British Association of Sexual Health & HIV. BASHH National Audit Group. 10-7-2014. 14-1-2015.

Ref Type: Online Source

http://www.bashh.org/BASHH/BASHH_Groups/National_Audit_Group/BASHH/BASHH_Groups/National_Audit_Group.aspx

(300) Horner P, Boag F, the Clinical Effectiveness Group. 2006 UK National Guideline for the Management of Genital Tract Infection with *Chlamydia trachomatis*. British Association for Sexual Health and HIV; 2006.

(301) Woolf SH, Grol R, Hutchinson A, Eccles M, Grimshaw J. Potential benefits, limitations, and harms of clinical guidelines. *BMJ* 1999 Feb 20;318:527-30.

(302) OPEN CLINICAL knowledge management for medical care. Clinical Pathways: multidisciplinary plans of best clinical practice. 8-7-2013. 16-8-2013.

Ref Type: Online Source

<http://www.openclinical.org/clinicalpathways.html>

(303) Cowan FM, French R, Johnson AM. The role and effectiveness of partner notification in STD control: a review. *Genitourin Med* 1996 Aug;72(4):247-52.

(304) Health and Social Care Information Centre. NHS Pathways. 2015. 6-4-2015.

Ref Type: Online Source

<http://systems.hscic.gov.uk/pathways>

(305) British Association of Sexual Health & HIV. BASHH Guidelines. 2015. 12-1-2015.

Ref Type: Online Source

<http://www.bashh.org/BASHH/Guidelines/Guidelines/BASHH/Guidelines/Guidelines.aspx>

(306) International Union against Sexually Transmitted Infections. IUSTI Current European Guidelines. 31-10-2014. 12-1-2015.

Ref Type: Online Source

<http://www.iusti.org/regions/Europe/euroguidelines.htm>

(307) General Medical Council. Standards and ethics guidance for doctors. 2015. 12-1-2015.

Ref Type: Online Source

http://www.gmc-uk.org/publications/standards_guidance_for_doctors.asp

(308) BASHH & MEDFASH. Standards for the management of sexually transmitted infections (STIs). 2014 Jan.

(309) Faculty of Sexual and Reproductive Healthcare. Clinical Guidance. 2014. 12-1-2015.

Ref Type: Online Source

http://www.fsrh.org/pages/clinical_guidance.asp

(310) Lim MS, Hocking JS, Hellard ME, Aitken CK. SMS STI: a review of the uses of mobile phone text messaging in sexual health. *Int J STD AIDS* 2008 May;19(5):287-90.

(311) Preventx Limited. test.me. 2015.

Ref Type: Online Source

<https://www.test.me/>

(312) Lloyds Pharmacy Online Doctor. Sexual Health Information. 2015. 26-5-2015.

Ref Type: Online Source

<https://onlinedoctor.lloydspharmacy.com/uk/info/sexual-health-information>

(313) Singh RH, Erbeling EJ, Zenilman JM, Ghanem KG. The role of speculum and bimanual examinations when evaluating attendees at a sexually transmitted diseases clinic. *Sex Transm Infect* 2007 Jun;83(3):206-10.

(314) Ling SB, Richardson DB, Mettenbrink CJ, Westergaard BC, Sapp-Jones TD, Crane LA, et al. Evaluating a Web-Based Test Results System at an Urban STI Clinic. *Sex Transm Dis* 2010.

(315) Brown L, Copas A, Stephenson J, Gilleran G, Ross JD. Preferred options for receiving sexual health screening results: a population and patient survey. *Int J STD AIDS* 2008 Mar;19(3):184-7.

(316) Llewellyn C, Pollard A, Miners A, Richardson D, Fisher M, Cairns J, et al. Understanding patient choices for attending sexually transmitted infection testing services: a qualitative study. *Sex Transm Infect* 2012 Nov;88(7):504-9.

(317) Martin L, Knight V, Read PJ, McNulty A. Clients' preferred methods of obtaining sexually transmissible infection or HIV results from Sydney Sexual Health Centre. *Sexual Health* 2013;10(1):91-2.

(318) Labacher L, Mitchell C. Talk or text to tell? How young adults in Canada and South Africa prefer to receive STI results, counseling, and treatment updates in a wireless world. *J Health Commun* 2013;18(12):1465-76.

(319) Steedman NM, Thompson C. Telephonetics RESULTS computer-facilitated telephone system: a novel method for patient results retrieval. *Int J STD AIDS* 2007 Jun;18(6):422-3.

(320) Evans-Jones J, Steedman N, Newman M, Jones R, Milburn A, O'Mahony C. Use of Telephonetics RESULTS computer-facilitated telephone system with automatic results upload. *Int J STD AIDS* 2011 Sep;22(9):525-6.

(321) National Chlamydia Screening Programme. Text messaging for test results communication within the National Chlamydia Screening Programme. 2013. 12-5-2015.

Ref Type: Online Source

http://www.chlamydia screening.nhs.uk/ps/resources/guidelines/Chlamydia_Test_Result_Notification_Text%20Messaging_NCSP_Recommendations_Jan_2013.pdf

- (322) Kohn R, Williams D, Klausner JD. Getting STD Test Results Over the Internet: San Francisco, 2005. 2006 National STD Prevention Conference . 9-5-2006. 21-12-2013.
Ref Type: Abstract
<http://cdc.confex.com/cdc/std2006/techprogram/P11122.HTM>
- (323) E-health insider. Amsterdam to launch STD clinic online. 22-10-2007. 21-12-2013.
Ref Type: Online Source
<http://ehi.co.uk/news/EHI/3114/amsterdam-to-launch-std-clinic-online>
- (324) Duncan B, Hart G, Scoular A, Bigrigg A. Qualitative analysis of psychosocial impact of diagnosis of Chlamydia trachomatis: implications for screening. BMJ 2001 Jan 27;322(7280):195-9.
- (325) Department of Health, NHS. Information Governance Toolkit. 2013. 1-12-2014.
Ref Type: Online Source
<https://www.igt.connectingforhealth.nhs.uk/Home.aspx?tk=413226979206263&cb=b4449775-5a6f-441c-806c-b637de245051&Inv=7&clnav=YES>
- (326) Gammell K. Mobile phone insurance: don't lose money if you lose your smartphone. 2012.
Ref Type: Online Source
<http://www.telegraph.co.uk/finance/personalfinance/insurance/9573224/Dont-lose-money-if-you-lose-your-smartphone.html>
- (327) Consumer Reports. Smart phone thefts rose to 3.1 million last year, Consumer Reports finds. 28-5-2014.
Ref Type: Online Source
<http://www.consumerreports.org/cro/news/2014/04/smart-phone-thefts-rose-to-3-1-million-last-year/index.htm>
- (328) Bracebridge S, Bachmann MO, Ramkhelawon K, Woolnough A. Evaluation of a systematic postal screening and treatment service for genital Chlamydia trachomatis, with remote clinic access via the internet: a cross-sectional study, East of England. Sex Transm Infect 2012 Aug;88(5):375-81.
- (329) Public Health England. Commissioning, reporting and using chlamydia activity data. 2013. 19-1-2015.
Ref Type: Online Source
<http://www.chlamydia-screening.nhs.uk/ps/info-management.asp>
- (330) National Chlamydia Screening Programme. Patient Group Direction for the administration of azithromycin for Chlamydia trachomatis. 2012. 20-4-2015.
Ref Type: Online Source
http://www.chlamydia-screening.nhs.uk/ps/resources/guidelines/NCSP_AZITHROMYCIN%20ADMINISTRATION%20PGD_Sept%202012_final.pdf
- (331) eMC. Azithromycin 500mg tablets SPC. 17-9-2013. 22-11-2013.
Ref Type: Online Source
<http://www.medicines.org.uk/EMC/medicine/21720/SPC/Azithromycin+500mg+Tablets/>
- (332) Electronic Medicines Compendium. Mizollen 10mg modified-release tablets summary of product characteristics. 18-5-2012. 12-12-0013.
Ref Type: Online Source

- (333) Nahata M. Drug interactions with azithromycin and the macrolides: an overview. *Journal of Antimicrobial Chemotherapy* 1996;37 Suppl C:133-42.
- (334) Owens RC, Jr., Nolin TD. Antimicrobial-associated QT interval prolongation: points of interest. *Clin Infect Dis* 2006 Dec 15;43(12):1603-11.
- (335) Mosholder AD, Mathew J, Alexander JJ, Smith H, Nambiar S. Cardiovascular risks with azithromycin and other antibacterial drugs. *N Engl J Med* 2013 May 2;368(18):1665-8.
- (336) Ray WA, Murray KT, Hall K, Arbogast PG, Stein CM. Azithromycin and the risk of cardiovascular death. *N Engl J Med* 2012 May 17;366(20):1881-90.
- (337) Svanstrom H, Pasternak B, Hviid A. Use of azithromycin and death from cardiovascular causes. *N Engl J Med* 2013 May 2;368(18):1704-12.
- (338) eMC. Erythromycin 250mg Capsules SPC. 28-10-2014. 20-1-2015.
Ref Type: Online Source
http://www.medicines.org.uk/emc/medicine/26315/SPC/Erythromycin+250mg+Capsules/#UNDESIRABLE_EFFECTS
- (339) The National Survey of Sexual Attitudes and Lifestyles. Natsal-3. 2014. 17-1-2015.
Ref Type: Online Source
<http://www.natsal.ac.uk/natsal-3>
- (340) Radcliffe KW, Flew S, Poder A, Cusini M. European guideline for the organization of a consultation for sexually transmitted infections, 2012. *Int J STD AIDS* 2012 Sep;23(9):609-12.
- (341) Fernando I, Thompson C. Testing time: testing patient acceptance and ability to self-screen for a No-Talk Testing service. *Int J STD AIDS* 2013.
- (342) Bowling A. *Research Methods in Health; Investigating Health and Health Services*. Third ed. McGraw Hill; 2009.
- (343) Macleod J, Salisbury C, Low N, McCarthy A, Sterne JA, Holloway A, et al. Coverage and uptake of systematic postal screening for genital Chlamydia trachomatis and prevalence of infection in the United Kingdom general population: cross sectional study. *BMJ* 2005 Apr 23;330(7497):940.
- (344) Ferreira A, Young T, Mathews C, Zunza M, Low N. Strategies for partner notification for sexually transmitted infections, including HIV. *Cochrane Database Syst Rev* 2013;10:CD002843.
- (345) Low N, Welch J, Radcliffe K. Developing national outcome standards for the management of gonorrhoea and genital chlamydia in genitourinary medicine clinics. *Sex Transm Infect* 2004 Jun;80(3):223-9.
- (346) Sutcliffe L, Brook MG, Chapman JL, Cassell JM, Estcourt CS. Is accelerated partner therapy a feasible and acceptable strategy for rapid partner notification in the UK?: a qualitative study of genitourinary medicine clinic attenders. *Int J STD AIDS* 2009 Sep;20(9):603-6.

- (347) Hopkins CA, Temple-Smith MJ, Fairley CK, Pavlin NL, Tomnay JE, Parker RM, et al. Telling partners about chlamydia: how acceptable are the new technologies? *BMC Infect Dis* 2010;10:58.
 - (348) Trelle S, Shang A, Nartey L, Cassell JA, Low N. Improved effectiveness of partner notification for patients with sexually transmitted infections: systematic review. *BMJ* 2007 Feb 17;334(7589):354.
 - (349) Althaus CL, Turner KM, Mercer CH, Auguste P, Roberts TE, Bell G, et al. Effectiveness and cost-effectiveness of traditional and new partner notification technologies for curable sexually transmitted infections: observational study, systematic reviews and mathematical modelling. *Health Technol Assess* 2014 Jan;18(2):1-viii.
 - (350) Lim MS, Bowring AL, Gold J, Aitken CK, Hellard ME. Trends in sexual behavior, testing, and knowledge in young people; 2006-2011. *Sex Transm Dis* 2012 Nov;39(11):831-4.
 - (351) Nicholas A, Bailey JV, Stevenson F, Murray E. The Sexunzipped trial: young people's views of participating in an online randomized controlled trial. *J Med Internet Res* 2013;15(12):e276.
 - (352) Allison S, Bauermeister JA, Bull S, Lightfoot M, Mustanski B, Shegog R, et al. The intersection of youth, technology, and new media with sexual health: moving the research agenda forward. *J Adolesc Health* 2012 Sep;51(3):207-12.
 - (353) Bailey JV, Murray E, Rait G, Mercer CH, Morris RW, Peacock R, et al. Interactive computer-based interventions for sexual health promotion. *Cochrane Database Syst Rev* 2010;(9):CD006483.
 - (354) McCarthy O, Carswell K, Murray E, Free C, Stevenson F, Bailey JV. What young people want from a sexual health website: design and development of Sexunzipped. *J Med Internet Res* 2012;14(5):e127.
 - (355) Jones K, Eathington P, Baldwin K, Sipsma H. The impact of health education transmitted via social media or text messaging on adolescent and young adult risky sexual behavior: a systematic review of the literature. *Sex Transm Dis* 2014 Jul;41(7):413-9.
 - (356) Bull SS, Levine DK, Black SR, Schmiede SJ, Santelli J. Social media-delivered sexual health intervention: a cluster randomized controlled trial. *Am J Prev Med* 2012 Nov;43(5):467-74.
 - (357) McClean H, Chair BASHH National Audit Group, Radcliffe KCBCEG, Sullivan ABNAGRCEG, Ahmed-Jushuf ICBCSU. BASHH Statement on Partner Notification for Sexually Transmissible Infections. 3-7-2012. 28-8-2013.
- Ref Type: Online Source
www.bashh.org/documents/4445.pdf
- (358) Lanjouw E, Ossewaarde JM, Stary A, Boag F, van der Meijden WI. 2010 European guideline for the management of Chlamydia trachomatis infections. *Int J STD AIDS* 2010 Nov;21(11):729-37.
 - (359) Society of Sexual Health Advisers. The Manual for Sexual Health Advisers. 2004. 1-12-2014.

- (360) Beatty PC, Willis GB. Research Synthesis: The Practice of Cognitive Interviewing. Public Opinion Quarterly 2007;71(2):287-311.
- (361) Horner P, Boag F, the Clinical Effectiveness Group. 2006 UK National Guideline for the Management of Genital Tract Infection with *Chlamydia trachomatis*. British Association for Sexual Health and HIV; 2006.
- (362) Gkatzidou V, Hone K, Sutcliffe L, Gibbs J, Sadiq ST, Szczepura A, et al. User interface design for mobile-based sexual health interventions for young people: design recommendations from a qualitative study on an online Chlamydia clinical care pathway. BMC Med Inform Decis Mak 2015;15:72.
- (363) Ammenwerth E, Graber S, Herrmann G, Burkle T, König J. Evaluation of health information systems-problems and challenges. Int J Med Inform 2003 Sep;71(2-3):125-35.
- (364) Nykanen P, Brender J, Talmon J, de KN, Rigby M, Beuscart-Zephir MC, et al. Guideline for good evaluation practice in health informatics (GEP-HI). Int J Med Inform 2011 Dec;80(12):815-27.
- (365) Brender J, Talmon J, de KN, Nykanen P, Rigby M, Ammenwerth E. STARE-HI - Statement on Reporting of Evaluation Studies in Health Informatics: explanation and elaboration. Appl Clin Inform 2013;4(3):331-58.
- (366) Eysenbach G. CONSORT-EHEALTH: improving and standardizing evaluation reports of Web-based and mobile health interventions. J Med Internet Res 2011;13(4):e126.
- (367) Shcherbatykh I, Holbrook A, Thabane L, Dolovich L. Methodologic issues in health informatics trials: the complexities of complex interventions. J Am Med Inform Assoc 2008 Sep;15(5):575-80.
- (368) Rothrock N, Kaiser K, Cella D. Developing a Valid Patient-Reported Outcome Measure. Clinical Pharmacology & Therapeutics 2011;90(5):737-42.
- (369) Hasin DS, Aharonovich E, Greenstein E. HealthCall for the smartphone: technology enhancement of brief intervention in HIV alcohol dependent patients. Addict Sci Clin Pract 2014;9:5.
- (370) Simoes AA, Bastos FI, Moreira RI, Lynch KG, Metzger DS. A randomized trial of audio computer and in-person interview to assess HIV risk among drug and alcohol users in Rio De Janeiro, Brazil. J Subst Abuse Treat 2006 Apr;30(3):237-43.
- (371) Cohall AT, Senathirajah Y, Dini S, Nye A, Powell D, Powell B. An online audio computer-assisted self-interview for pre-screening prior to rapid HIV testing in a vulnerable population. AMIA Annu Symp Proc 2007;915.
- (372) Mevissen FE, Eiling E, Bos AE, Tempert B, Mientjes M, Schaalma HP. Evaluation of the Dutch AIDS STI information helpline: differential outcomes of telephone versus online counseling. Patient Education & Counseling 2012;88(2):218-23.

- (373) Postel MG, De Haan HA, De Jong CA. Evaluation of an e-therapy program for problem drinkers: a pilot study. *Subst Use Misuse* 2010 Oct;45(12):2059-75.
- (374) Gajecki M, Berman AH, Sinadinovic K, Rosendahl I, Andersson C. Mobile phone brief intervention applications for risky alcohol use among university students: a randomized controlled study. *Addict Sci Clin Pract* 2014;9:11.
- (375) Bauermeister JA, Zimmerman MA, Johns MM, Glowacki P, Stoddard S, Volz E. Innovative recruitment using online networks: lessons learned from an online study of alcohol and other drug use utilizing a web-based, respondent-driven sampling (webRDS) strategy. *J Stud Alcohol Drugs* 2012 Sep;73(5):834-8.
- (376) Evans R, Joseph-Williams N, Edwards A, Newcombe RG, Wright P, Kinnersley P, et al. Supporting informed decision making for prostate specific antigen (PSA) testing on the web: an online randomized controlled trial. *Journal of Medical Internet Research* 2010;12(3).
- (377) Moessner M, Bauer S. Online counselling for eating disorders: reaching an underserved population? *J Ment Health* 2012 Aug;21(4):336-45.
- (378) Christensen H, Griffiths KM, Mackinnon AJ, Kalia K, Batterham PJ, Kenardy J, et al. Protocol for a randomised controlled trial investigating the effectiveness of an online e health application for the prevention of Generalised Anxiety Disorder. *BMC Psychiatry* 2010;10.
- (379) Atienza AA, Hesse BW, Baker TB, Abrams DB, Rimer BK, Croyle RT, et al. Critical Issues in eHealth Research. *Am J Prev Med* 2007;32(5S):S71-S74.
- (380) Brown W, III, Yen PY, Rojas M, Schnall R. Assessment of the Health IT Usability Evaluation Model (Health-ITUEM) for evaluating mobile health (mHealth) technology. *J Biomed Inform* 2013 Dec;46(6):1080-7.
- (381) Medical Research Council. Developing and evaluating complex interventions: new guidance. 2010. 1-5-2015.
Ref Type: Online Source
www.mrc.ac.uk/complexinterventionsguidance
- (382) Talmon J, Enning J, Castaneda G, Eurlings F, Hoyer D, Nykanen P, et al. The VATAM guidelines. *Int J Med Inform* 1999 Dec;56(1-3):107-15.
- (383) Ammenwerth E, Brender J, Nykanen P, Prokosch HU, Rigby M, Talmon J. Visions and strategies to improve evaluation of health information systems. Reflections and lessons based on the HIS-EVAL workshop in Innsbruck. *Int J Med Inform* 2004 Jun 30;73(6):479-91.
- (384) Gustafson DH, Wyatt JC. Evaluation of ehealth systems and services. *BMJ* 2004 May 15;328(7449):1150.
- (385) Dansky KH, Thompson D, Sanner T. A framework for evaluating eHealth research. *Eval Program Plann* 2006 Nov;29(4):397-404.
- (386) May C. A rational model for assessing and evaluating complex interventions in health care. *BMC Health Serv Res* 2006;6:86.

- (387) Yusof MM, Papazafeiropoulou A, Paul RJ, Stergioulas LK. Investigating evaluation frameworks for health information systems. *Int J Med Inform* 2008 Jun;77(6):377-85.
- (388) Turner J, Latimer V, Snooks H. An evaluation of the accuracy and safety of NHS Pathways. 2008. 8-5-2015.

Ref Type: Online Source

<http://systems.hscic.gov.uk/pathways/about/eval.pdf>

- (389) Catwell L, Sheikh A. Evaluating eHealth interventions: the need for continuous systemic evaluation. *PLoS Med* 2009 Aug;6(8):e1000126.
- (390) Lilford RJ, Foster J, Pringle M. Evaluating eHealth: how to make evaluation more methodologically robust. *PLoS Med* 2009 Nov;6(11):e1000186.
- (391) Cummings E, Turner P. Patients at the centre: methodological considerations for evaluating evidence from health interventions involving patients use of web-based information systems. *Open Med Inform J* 2010;4:188-94.
- (392) Kumar S, Nilsen WJ, Abernethy A, Atienza A, Patrick K, Pavel M, et al. Mobile health technology evaluation: the mHealth evidence workshop. *Am J Prev Med* 2013 Aug;45(2):228-36.
- (393) Ammenwerth E, Mansmann U, Iller C, Eichstadter R. Factors affecting and affected by user acceptance of computer-based nursing documentation: results of a two-year study. *J Am Med Inform Assoc* 2003 Jan;10(1):69-84.
- (394) Lobach DF, Detmer DE. Research challenges for electronic health records. *Am J Prev Med* 2007 May;32(5 Suppl):S104-S111.
- (395) Berg M. Implementing information systems in health care organizations: myths and challenges. *Int J Med Inform* 2001 Dec;64(2-3):143-56.
- (396) Murray E, Khadjesari Z, White IR, Kalaitzaki E, Godfrey C, McCambridge J, et al. Methodological challenges in online trials. *J Med Internet Res* 2009;11(2):e9.
- (397) <http://www-vatam.unimaas.nl/>. 1998. 19-5-0015.

Ref Type: Online Source

<http://www-vatam.unimaas.nl/>

- (398) Talmon J, Ammenwerth E, Brender J, de KN, Nykanen P, Rigby M. STARE-HI--Statement on reporting of evaluation studies in Health Informatics. *Int J Med Inform* 2009 Jan;78(1):1-9.
- (399) de Keizer NF, Ammenwerth E. The quality of evidence in health informatics: how did the quality of healthcare IT evaluation publications develop from 1982 to 2005? *Int J Med Inform* 2008 Jan;77(1):41-9.
- (400) Ammenwerth E, Schnell-Inderst P, Siebert U. Vision and challenges of Evidence-Based Health Informatics: a case study of a CPOE meta-analysis. *Int J Med Inform* 2010 Apr;79(4):e83-e88.

- (401) Weir CR, Staggers N, Phansalkar S. The state of the evidence for computerized provider order entry: a systematic review and analysis of the quality of the literature. *Int J Med Inform* 2009 Jun;78(6):365-74.
- (402) Michael BJ, Rimer BK, Lyons EJ, Golin CE, Frydman G, Ribisl KM. Methodologic challenges of e-health research. *Eval Program Plann* 2006 Nov;29(4):390-6.
- (403) Heathfield H, Pitty D, Hanka R. Evaluating information technology in health care: barriers and challenges. *BMJ* 1998 Jun 27;316(7149):1959-61.
- (404) Garcia de Yebenes Prous MA, Rodriguez SF, Carmona OL. [Validation of questionnaires]. *Reumatol Clin* 2009 Jul;5(4):171-7.
- (405) Weston RL, Hopwood B, Harding J, Sizmur S, Ross JD. Development of a validated patient satisfaction survey for sexual health clinic attendees. *Int J STD AIDS* 2010 Aug;21(8):584-90.
- (406) National Institute for Health and Care Excellence. Prevention of sexually transmitted infections and under 18 conceptions. 2007. 14-11-2013.
Ref Type: Online Source
<https://www.nice.org.uk/guidance/ph3>
- (407) Pequegnat W, Rosser BR, Bowen AM, Bull SS, DiClemente RJ, Bockting WO, et al. Conducting Internet-based HIV/STD prevention survey research: considerations in design and evaluation. *AIDS Behav* 2007 Jul;11(4):505-21.
- (408) Karras BT, Tufano JT. Multidisciplinary eHealth survey evaluation methods. *Eval Program Plann* 2006 Nov;29(4):413-8.
- (409) University Hospitals Birmingham NHS Trust. Patient Satisfaction Survey for STI Clinics. 2013. 3-12-2015.
Ref Type: Online Source
http://www.bashh.org/BASHH/Education/Patient_Satisfaction_Survey_for_STI_Clinics/BASHH/Education/Patient_Satisfaction_Survey_for_STI_Clinics.aspx?hkey=16d8ba26-9d7b-4bca-a40b-75563a2d76f9
- (410) Likert R. A technique for the measurement of attitudes. *Archives of Psychology* 1932;22:1-55.
- (411) Rothwell PM. External validity of randomised controlled trials: "to whom do the results of this trial apply?". *Lancet* 2005 Jan 1;365(9453):82-93.
- (412) Khoja S, Durrani H, Scott RE, Sajwani A, Piryani U. PANACeA eHealth Evaluation. 2013. 3-2-2015.
Ref Type: Online Source
<http://panacea-evaluation.yolasite.com/evaluation-tools.php>
- (413) Norris TA, Paul P, Norris AH. Limited benefit of repeating a sensitive question in a cross-sectional sexual health study. *BMC Med Res Methodol* 2013;13:34.

Appendix I – mobile app review exclusions

Platform	Title of App	Author	Country	Region	Number of downloads	Rating	Number of ratings	Age restriction	Theme (e.g. health & fitness)	Price (£)	Last date updated	Author's description of app	Our description of app	Target audience	Reason for exclusion
iOS	Myths of Sexually Transmitted Diseases	Jorge Gregorio Martin Bello	-	-	-	No rating	0	17+	Health& Fitness	0.69	18/05/2013	Enjoy and learn at the same time. Make the quiz to know the myths and facts of sexually transmitted diseases (STIs).	Questions and answers about STIs	General public	Sex Trivia
iOS	STD Dating Tips	Successful Match.com	-	-	-	No rating	0	17+	Books	0	26/04/2013	For people with STDs to find help and support	App for people with STIs providing info on how to date and support from other users	People with STI	No information on STD. Dating tips and support from other users
iOS	HSCC HIV/STD Application	Bohung Wang	USA	-	-	No rating	0	4+	Health& Fitness	0	19/03/2013	This application allows quick and intuitive access to a variety of resources for preventing, detecting and treating STDs and AIDS.	Majority of info on HIV/AIDS	General public	Focussed on HIV/AIDS. Any reference to STDs are to links to external websites for information
iOS	Chec-Mate	STFree Inc.	USA	-	-	No rating	0	4+	Lifestyle	0	18/02/2012	Allows users to instantly locate a local screening facility to schedule an STI/ HIV screening then securely store the results for confidential sharing or verification with current or potential partner.	Allows users to locate local screening facilities, securely store the results for confidential sharing or verification with current or potential partner.	People with STI	Requires subscription
iOS	BeForeplay	Near Death LLC	-	-	-	No rating	0	12+	Lifestyle	0	05/03/2014	BeForeplay is the STD communication app. For many people it is awkward and uncomfortable to ask a partner about their sexual history and health. BeForeplay's goal is to promote this crucial dialogue and to document that the conversation occurred.	Provides documentation that both parties disclosed whether they have or do not have STDs before engaging in sex	General public	Initially assessed by 1 researcher and excluded by another researcher. When I tried to review it on 5/12/14 I was unable to find it
iOS	Herpes	Personal Remedies, LLC	-	-	-	No rating	0	12+	Medical	2.49	07/08/2014	This app represents the most comprehensive and actionable nutrition guidelines for how to combat herpes and its symptoms.	Suggestions on food may help combat herpes symptoms	People with STI	Require username and password
iOS	STDs - Sexually Transmissible Diseases	Christian Schneider	Germany	-	-	No rating	0	12+	Health & fitness	1.99	05/09/2012	This app gives you the possibility to determine potential diseases, simply by selecting symptoms.	Determine disease by selecting symptoms	People with STI	No original content. Links to secondary source
iOS	Wart Removal+	Daniel Burford	-	-	-	No rating	0	12+	Medical	1.49	01/11/2011	Contact us to find out more at wellthepvapp@gmail.com		General public	Unable to find
iOS	The Curse of the Tree-Man HD	University of Nebraska - Lincoln	-	-	-	No rating	0	9+	Education	0	09/02/2012	Narrated interactive comic that tells the story of how HPV attacks the body.		General public	Unable to find

Platform	Title of App	Author	Country	Region	Number of downloads	Rating	Number of ratings	Age restriction	Theme (e.g. health & fitness)	Price (£)	Last date updated	Author's description of app	Target audience	Target audience_4	Include/Exclude	Reason for exclusion
Android	How to Cure Yeast Infection!	big0	-	-	5000	4.2	13	low maturity	health and fitness	free	12/02/2012	"Curing Yeast Infections the Natural Way" E-Book: The general yeast infection facts that you must know.	1	-	2	Second researcher unable to find app
Android	How2use Condom	Easytime Studio	-	-	50	5	1	medium maturity	education	£0.99	14/09/2011	Do you know how to use condom correctly? This app shows you 16 kinds of usages of condom.	1	-	2	Solely focussed on condom use, but no use related to sex i.e. to use the condom as a hairband
Android	Kelaha Projects	Bizmark agency	-	-	10	n/a	0	medium maturity	medical	free	11/04/2014	To be an unrelenting advocate in the fight against cervical cancer, Kelaha Projects is creating greater awareness nationally about the disease, while promoting ways of prevention and early detection and serving as a reliable center for support and access to counselling for persons and their families battling or otherwise affected by cervical cancer, all through enlisting the involvement and support of the community in various activities and programs.	1	-	2	No information about sexual health or cervical cancer. Just information about the organisation Kelaha Projects that petition to raise awareness.
Android	Konjy	Konjy	-	-	50	4.5	6	medium maturity	health and fitness	free	04/09/2014	Reproductive health mobile app. Contains info about sex positions and sexually transmitted infections.	1	-	2	Requires login / sign up by providing phone no and email address
Android	Learn about STDs	Andrew Burnetty	-	-	?	n/a	0	everyone	health and fitness	free	15/09/2014	Learn about sexually transmitted diseases in the privacy of your own home with this video series on STDs. Health education expert Jane Bogart explains how to treat and prevent crabs, AIDS, herpes, HPV, chlamydia, gonorrhea, syphilis, Hepatitis C, and other venereal diseases. Don't miss the video on the top sex myths.	1	-	2	unable to find
Android	Love H Style	iGraphic Designs	-	-	500	2	4	medium maturity	social	free	22/10/2013	Love H Style is an online social networking community where you can find plenty of helpful information about Herpes (HSV-1, HSV-2), HIV & HPV. We also allow you to meet singles throughout the world that come here to gather in search of information, support, friendships, and romance.	1	-	2	Crashed on more than 2 occasions
Android	M4Mobile	Southern Tier AIDS Program Inc	-	-	500	4.3	6	low maturity	social	free	04/08/2014	Beyond the social aspects of MSM, we encourage guys to participate in regularly scheduled groups during which they can talk openly about dating, relationships, and safer sex practices. We also provide safer sex materials and information. Free, confidential HIV testing is also available on site at regularly scheduled times and by appointment.	4	MSM	2	No sexual health info. Condom finder for USA
Android	Mole and Wart Remover	big0	-	-	10,000	3.3	18	everyone	health and fitness	free	12/02/2012	Info on natural remedies for warts and moles. HPV can cause outbreaks of warts in various parts of the body and at different times. It is also the underlying cause of genital warts, which is a sexually transmitted disease (STD).	1	-	2	Doesn't discuss genital warts
Android	Play Safe	CareXO	-	-	100	5	1	low maturity	health and fitness	free	07/07/2013	A CareXO.com membership and the PlaySafe™ app provide you with an innovative way to stay aware of your sexual health AND share your 3rd party verified STD status with anyone you choose in the most private and sensitive methods possible.	1	-	2	Requires membership, username and password. You have to sign up and then visit your local test centre. Second author unable to find app.
Android	Random Sex Facts	Sociometrics Corporation	-	-	5,000	2.8	19	high maturity	education	free	20/11/2012	Learn something new every day! Check out the Fact of the Day and put your sexual health IQ to the test. (ages 13-18) Learn about common STI symptoms, contraceptive facts and the latest HIV and teen pregnancy statistics.	1	-	2	Comes up as 1 fact as a time so unable to assess overall content. First 10 questions related to pregnancy. Sex trivia
Android	S.U.P.E.R. Condomizer	refraction	-	-	100	4.4	10	low maturity	casual	free	0/12/13	S.U.P.E.R. Condomizer is a game born from the collaboration between S.U.P.E.R. (a Bulgarian Y-PEER organization) and Refraction, for the 10 Days of Activism Campaign 2013. This project aims at raising awareness about sexually transmitted diseases and encourage people to use protection. In the game you are lonely spermatozoon which has to avoid diseases as it gets harder and harder through the never-ending journey.	1	-	2	No way of getting information to display apart from getting hit by the sperm during the game. Information extremely brief. Primarily a game, with sex trivia, not an information app.
Android	Sex Education for Children	Fas F	-	-	100	2	1	high maturity	education	free	01/08/2014	App for providing sex education for children on topics such as puberty, STDs, pregnancy.	1	-	2	App is unoperational. Each topic has a link to a video, the videos can not be played.
Android	Sex Facts	Text Maids	-	-	100	4.3	17	high maturity	lifestyle	free	23/08/2014	best collection of Sex Facts for your mobile device? This app is filled with fun facts about sex, random, funny and interesting. Learn weird sex facts about women and men that you might find odd, crazy or awesome! Discover how to improve your safe sex life and learn sex education facts that can help dispel common myths associated with orgasms and other sex related behavior. This is an educational app with fun sex facts and tips that are for mature adult male and females only.	1	-	2	unable to find app

Platform	Title of App	Author	Country	Region	Number of downloads	Rating	Number of ratings	Age restriction	Theme (e.g. health & fitness)	Price (£)	Last date updated	Author's description of app	Target audience	Target audience_4	Include/Exclude	Reason for exclusion
Android	Sex Facts for You	Android Appmaker	-	-	500	n/a	0	high maturity	health and fitness	free	06/01/2014	Enjoy this application with some interesting facts.	1	-	2	Sextrivia. No sexual health info.
Android	Sexual Health	Droid App Team	-	-	10,000	4.1	63	everyone	health and fitness	free	05/03/2011	Do you know what should you pay your attention to while have a baby? Do you know what should cause Uterine Cancer? Do you know how pelvic pain would occur? You can find all these answers in the Sexual health application, it also contain more useful information about health, with it in hand you could live more healthy.	1	-	2	Crashed on multiple occasions when trying to access items on the initial menu, unable to find app
Android	Sexual Health	Medicine Help	-	-	10	n/a	0	high maturity	health and fitness	free	09/09/2014	Sexual Health is an app that provides you with important tips to maintain happy and healthy sex life. We all seem to know enough about such natural thing as sex, but do we really? With Sexual Health we will have no doubts you are well informed about key factors of wholeness and harmony in your bedroom.	1	-	2	Unable to find
Android	Sexual Health and You	Medisurge Technologies P Ltd	-	-	5,000	4.2	21	high maturity	health and fitness	free	18/12/2012	The application also provides users a collection of most asked questions on the topic and their answers by provided by renowned sexologists. Sexual Health is one of the highest consumed health content on digital media. Health seekers are reluctant in meeting sexologists in person, hence rely on family and friends for solutions to their sexual problems.	1	-	2	Series of questions answered in a forum format. Crashed on several occasions. Second researcher found that the app could not be operated
Android	Smart AIDS	ANLAIDS	-	-	1000	4.4	29	high maturity	social	free	23/07/2014	This is the first Application about HIV/AIDS prevention and education. Learn more about all sexual transmitted diseases (STD). Test your knowledge about STDs with a quiz.	1	-	2	text not in English even though app description was.
Android	STD checker lite	Luke Pamment	-	-	1000	3	4	medium maturity	entertainment	free	05/01/2013	Scan your friends and yourself for STD's! Lite version includes: - 30% chance to come up clean - A non-fatal STD's and STI's Statistics/Information and symptoms of each disease - Funny comments for each disease - Raises the awareness of STD's and STI's Ad supported. Please note that this app is strictly for fun. Any correlation to disease that the user may really have is strictly coincidental.	1	-	2	In game format with trivia re STIs. You press a button to fill a syringe full of blood and then it either announces that you have an STI and gives you a bit of information on that STI or it tells you that you are 'clean'.
Android	STD Risk calculator lite	Universal Web solutions CA	-	-	5,000	4.5	87	high maturity	health and fitness	free	0/4/12	STD Risk Calculator is a risk assessment tool to determine the chance that you picked up a sexually transmitted infection (STI).	1	-	2	There is no info on how their algorithm works and no info about the infections. On the free app it will only tell you your risk of having one infection. If you pay to upgrade it apparently gives you colour graphs of all the probabilities. No information to evaluate really. Unable to find app
Android	STD Testing	Talisman Capital Inc	-	-	5,000	4.1	11	medium maturity	medical	free	15/08/2012	The tests we offer are the same tests that backbone hospitals and doctors use. We work with LabCorp and Quest, the nation's largest and most respected diagnostic laboratories. All tests offered are FDA-approved or CLIA-certified, and are the most sophisticated tests available for sexually-transmitted infection screening.	1	-	2	Links straight to external website. No information on STIs - just a way of getting tested with prices of tests
Android	STDcommunity.com	STD Community	-	-	1000	2.1	10	medium maturity	entertainment	free	18/02/2013	STD Community is a dating and social networking site for people with Herpes, HIV, Hep C & other STD's and STI's. Come join our community today and chat with others from around the globe. Must be 18 years or older to join.	2	-	2	Requires log in
Android	Symptoms of STDs and Treatment	Cool Help Guide	-	-	0	n/a	0	high maturity	health and fitness	free	19/04/2014	Symptoms of STDs and Treatment	1	-	2	unable to find app
Android	Symptoms of STDs Helpful Guide	WE HELP YOU	-	-	500	2.2	4	high maturity	health and fitness	free	02/09/2014	Dealing With STDs: Symptoms, Signs, Cures and Prevention	1	-	2	Unable to find
Android	The Party's Over	Master and Bull Digital Arts Pvt Ltd	-	-	100	n/a	0	low maturity	education	free	22/10/2013	The Party's Over: Sex, Alcohol & Pregnancy is a live-action program that tells the story of three teenage couples dealing with a variety of contemporary sexual health and relationship issues. Presented in the context of a party, the couples and their peers explore their experiences and feelings about committed relationships, sexual involvement, sexually transmitted infections (STIs) and pregnancy in both serious and comedic interactions. The role of alcohol in unplanned sexual activity is a key focus, as are male responsibilities and safer sex.	1	-	2	The app contains links to different videos, and all went play when they are click on. Unable to use the app.
Android	Viral-Dating - Meet Herpes/HIV	Viral-Dating	-	-	10	1	1	medium maturity	lifestyle	£0.99	11/11/2013	Estimates put the number of us affected by herpes/HIV at between 15-20% of the population. What does that mean? You're not alone! Download the Viral-Dating.com app to connect with other herpes/HIV singles near you for dating, friendship, camaraderie and more.	2	-	2	Requires log in
Android	What is Herpes?	Ashley Cotter-Cairns	-	-	500	n/a	0	medium maturity	health and fitness	free	11/08/2012	What is Herpes? teaches you everything you need to know about this virus. Wud UP lets you find out how some young people end up being sexually exploited. You can think about the decisions you would make if you were in the same situation, and get advice about your decisions.	1	-	2	Links only to external websites e.g. WebMD information/ herpes guide/NHS choices
Android	Wud UP?	Barnado's	-	-	500	4.8	12	medium maturity	lifestyle	free	12/05/2014	Through Wud UP, you can: - find out how to make safe decisions to help prevent yourself from being sexually exploited - understand more about sexual exploitation - get support if you or a friend are at risk of sexual exploitation	1	-	2	Second author unable to download despite sufficient space

Platform	Title of App	Author	Country	Region	Number of downloads	Android rating	iTune Rating	Android number of ratings	iTune Number of ratings	Android age restriction	iTune Age restriction	Android Theme	itune Theme (e.g. health & fitness)	Price (£)	iTune last date updated	Android Last date updated	Author's description of app	Target audience	Target audience_4	Include/Exclude	Reason for exclusion
Both	Herpes	Personal Remedies, LLC	USA	Boston	1 to 5	0	No rating	0	0	Everyone	12+	Medical	Medical	2.49	23/07/2014	07/10/2014	This app represents the most comprehensive and actionable nutrition guidelines for how to combat herpes and its symptoms.	2	-	2	Require username and password
Both	HPV.edu	Cristyn Davies	-	-	100	3	1	2	1	Everyone	4+	Medical	Medical	0	10/03/2014	03/03/2014	HPV.edu is an app for young people, their family, and educators. Be informed about Human Papillomavirus (HPV) and HPV vaccination! HPV is a virus which infects body surfaces. There are many types of HPV. Most are harmless, but some can have more serious effects on the body. The most serious kinds can cause several types of cancer. Some other types can cause genital warts.	4	Young people	2	Requires username and password to login
Both	RU Sure	ICE	UK	Chester, Cheshire	10 to 50	2	No rating	1	0	Low Maturity	12+	Health & Fitness	Health & Fitness	0	25/12/2012		This app provides help and advice on sexual health, contraception, and STIs and lets you know your options if you think you may be pregnant. It shows you the locations of these services in the Chester and Cheshire areas.	1	-	2	Crashed on multiple occasions
Both	SexFactor	ICE	UK	Wirral	10,000 - 50,000	3.5	No rating	64	0	Medium Maturity	12+	Lifestyle	Lifestyle	0	17/07/2013		How much do you know about chlamydia and safer sex? Can you sort out the myths from the facts? Play our game to find out.	4	People living in wirral	2	Good information but unable to assess as it only comes in the format of questions and answers
Both	Sexie	Borderless healthlab Pte.Ltd	-	-	100 - 500	1	No rating	2	0	Low Maturity	12+	Medical	Health & fitness	0	17/06/2014	12/06/2014	Sex Xpert Interactive Education (S.E.X.X.I.E.) app is an interactive online/ mobile learning application on sexual health. With a module titled Sexually Transmitted Infections (STI), it will give users education and knowledge on different types of STIs, how to prevent and practice safe sex.	1	-	2	Requires paid subscription
Both	Well Happy	NHS London	UK	London	500-1000	4.6	8	8	2	Medium Maturity	17	Health & Fitness	Health & fitness	0	26/03/2013	03/04/2013	Well Happy is a free health app for young people aged 12-25 in London. It allows you to search thousands of local support services in and around London including mental health, sexual health, drugs, alcohol and smoking services.	4	People living in London	2	App not functioning, so unable to view the comprehensiveness and accuracy of sexual health terms

Appendix II – search strategy

The following search strategies are described here:

1. Electronic prescribing
2. Development of online clinical consultation: data gathering
3. Development of online clinical consultation: decision support
4. Development of online clinical consultation: results service
5. Development of online clinical consultation: partner notification
6. Validation and evaluation of an online clinical care pathway
7. Validation and evaluation of a results service
8. Validation and evaluation of an online clinical consultation
9. Validation and evaluation of a partner notification service
10. Validation and evaluation of an electronic prescribing service

Electronic prescribing

1. MEDLINE; ELECTRONIC PRESCRIBING/; 556 results.
2. MEDLINE; exp ELECTRONIC PRESCRIBING/; 556 results.
3. MEDLINE; PHARMACEUTICAL SERVICES, ONLINE/; 28 results.
4. MEDLINE; exp PHARMACEUTICAL SERVICES, ONLINE/; 28 results.
5. MEDLINE; MEDICAL ORDER ENTRY SYSTEMS/; 1613 results.
6. MEDLINE; exp MEDICAL ORDER ENTRY SYSTEMS/; 1613 results.
7. MEDLINE; DRUG THERAPY, COMPUTER-ASSISTED/; 1560 results.
8. MEDLINE; exp DRUG THERAPY, COMPUTER-ASSISTED/; 1560 results.
9. MEDLINE; 1 OR 2; 556 results.
10. MEDLINE; 3 OR 4; 28 results.
11. MEDLINE; 5 OR 6; 1613 results.
12. MEDLINE; 7 OR 8; 1560 results.
13. MEDLINE; ORGANIZATION AND ADMINISTRATION/; 14335 results.
14. MEDLINE; exp ORGANIZATION AND ADMINISTRATION/; 1084680 results.
15. MEDLINE; REFERENCE STANDARDS/; 34644 results.
16. MEDLINE; exp REFERENCE STANDARDS/; 35524 results.
17. MEDLINE; JURISPRUDENCE/ OR LEGISLATION AS TOPIC/ OR LEGISLATION, MEDICAL/; 57675 results.
18. MEDLINE; exp JURISPRUDENCE/ OR exp LEGISLATION AS TOPIC/ OR exp LEGISLATION, MEDICAL/; 297441 results.
19. MEDLINE; UTILIZATION REVIEW/; 7189 results.
20. MEDLINE; exp UTILIZATION REVIEW/; 10563 results.
21. MEDLINE; 13 OR 14; 1084680 results.
22. MEDLINE; 15 OR 16; 35524 results.
23. MEDLINE; 17 OR 18; 297441 results.
24. MEDLINE; 19 OR 20; 10563 results.
25. MEDLINE; exp INAPPROPRIATE PRESCRIBING/ OR exp MEDICATION ERRORS/; 11313 results.
26. MEDLINE; INAPPROPRIATE PRESCRIBING/ OR MEDICATION ERRORS/; 11137 results.
27. MEDLINE; 25 OR 26; 11313 results.
28. MEDLINE; GREAT BRITAIN/; 187012 results.
29. MEDLINE; exp GREAT BRITAIN/; 301726 results.
30. MEDLINE; ENGLAND/; 74468 results.
31. MEDLINE; exp ENGLAND/; 89575 results.
32. MEDLINE; 28 OR 29; 301726 results.
33. MEDLINE; 30 OR 31; 89575 results.
34. MEDLINE; 9 OR 10 OR 11 OR 12; 3436 results.
35. MEDLINE; 21 OR 22 OR 23 OR 24; 1321926 results.
36. MEDLINE; 32 OR 33; 301726 results.
37. MEDLINE; 34 AND 35; 2307 results.
38. MEDLINE; 34 AND 35 AND 36; 55 results.
39. MEDLINE; 27 AND 34; 854 results.
40. MEDLINE; 27 AND 34 AND 36; 28 results.
41. MEDLINE; 37 [Limit to: English Language and Humans and Publication Year 1993-Current and (Age Groups All Adult 19 plus years or Adolescent 13 to 18 years)]; 389 results.
42. MEDLINE; 41 [Limit to: English Language and Review Articles and Humans and Publication Year 1993-Current and (Age Groups All Adult 19 plus years or Adolescent 13 to 18 years)]; 18 results.

43. MEDLINE; 39 [Limit to: English Language and Humans and Publication Year 1993-Current and (Age Groups All Adult 19 plus years or Adolescent 13 to 18 years)]; 151 results.
44. MEDLINE; 43 [Limit to: English Language and Review Articles and Humans and Publication Year 1993-Current and (Age Groups All Adult 19 plus years or Adolescent 13 to 18 years)]; 12 results.

DEVELOPMENT OF ONLINE CLINICAL CONSULTATION – DATA GATHERING

1. MEDLINE; DATA COLLECTION/; 78262 results.
2. MEDLINE; exp DATA COLLECTION/; 1520880 results.
3. MEDLINE; HEALTH SURVEYS/; 49994 results.
4. MEDLINE; exp HEALTH SURVEYS/; 426202 results.
5. MEDLINE; QUESTIONNAIRES/; 310265 results.
6. MEDLINE; exp QUESTIONNAIRES/; 318342 results.
7. MEDLINE; MEDICAL HISTORY TAKING/; 17115 results.
8. MEDLINE; exp MEDICAL HISTORY TAKING/; 18623 results.
9. MEDLINE; INTERVIEWS AS TOPIC/; 44148 results.
10. MEDLINE; exp INTERVIEWS AS TOPIC/; 59269 results.
11. MEDLINE; 1 OR 2; 1520880 results.
12. MEDLINE; 3 OR 4; 426202 results.
13. MEDLINE; 5 OR 6; 318342 results.
14. MEDLINE; 7 OR 8; 18623 results.
15. MEDLINE; 9 OR 10; 59269 results.
16. MEDLINE; 11 OR 12 OR 13 OR 14 OR 15; 1533468 results.
17. MEDLINE; METHODS/; 235293 results.
18. MEDLINE; exp METHODS/; 590192 results.
19. MEDLINE; REFERENCE STANDARDS/; 34649 results.
20. MEDLINE; exp REFERENCE STANDARDS/; 35530 results.
21. MEDLINE; ORGANIZATION AND ADMINISTRATION/; 14335 results.
22. MEDLINE; exp ORGANIZATION AND ADMINISTRATION/; 1084907 results.
23. MEDLINE; 17 OR 18; 590192 results.
24. MEDLINE; 19 OR 20; 35530 results.
25. MEDLINE; 21 OR 22; 1084907 results.
26. MEDLINE; 23 OR 24 OR 25; 1672599 results.
27. MEDLINE; SELF DISCLOSURE/; 6855 results.
28. MEDLINE; exp SELF DISCLOSURE/; 6855 results.
29. MEDLINE; SOCIAL DESIRABILITY/; 4024 results.
30. MEDLINE; exp SOCIAL DESIRABILITY/; 4024 results.
31. MEDLINE; ATTITUDE TO COMPUTERS/; 3997 results.
32. MEDLINE; exp ATTITUDE TO COMPUTERS/; 3997 results.
33. MEDLINE; 27 OR 28; 6855 results.
34. MEDLINE; 29 OR 30; 4024 results.
35. MEDLINE; 31 OR 32; 3997 results.
36. MEDLINE; 33 OR 34 OR 35; 14773 results.
37. MEDLINE; ONLINE SYSTEMS/; 7361 results.
38. MEDLINE; exp ONLINE SYSTEMS/; 13636 results.

39. MEDLINE; 37 OR 38; 13636 results.
40. MEDLINE; REMOTE CONSULTATION/; 3659 results.
41. MEDLINE; exp REMOTE CONSULTATION/; 3659 results.
42. MEDLINE; 40 OR 41; 3659 results.
43. MEDLINE; 39 OR 42; 17257 results.
44. MEDLINE; 16 AND 26 AND 43; 1511 results.
45. MEDLINE; 16 AND 36 AND 43; 114 results.
46. MEDLINE; 44 [Limit to: English Language and Humans and Publication Year 1993-2013 and (Age Groups All Adult 19 plus years or Adolescent 13 to 18 years)]; 431 results.

DEVELOPMENT OF ONLINE CLINICAL CONSULTATION – DECISION SUPPORT

1. MEDLINE; DECISION MAKING/; 69986 results.
2. MEDLINE; exp DECISION MAKING/; 123969 results.
3. MEDLINE; DECISION SUPPORT SYSTEMS, CLINICAL/; 5235 results.
4. MEDLINE; exp DECISION SUPPORT SYSTEMS, CLINICAL/; 5235 results.
5. MEDLINE; 1 OR 2; 123969 results.
6. MEDLINE; 3 OR 4; 5235 results.
7. MEDLINE; 5 OR 6; 128957 results.
8. MEDLINE; METHODS/; 235293 results.
9. MEDLINE; exp METHODS/; 590192 results.
10. MEDLINE; REFERENCE STANDARDS/; 34649 results.
11. MEDLINE; exp REFERENCE STANDARDS/; 35530 results.
12. MEDLINE; ORGANIZATION AND ADMINISTRATION/; 14335 results.
13. MEDLINE; exp ORGANIZATION AND ADMINISTRATION/; 1084907 results.
14. MEDLINE; JURISPRUDENCE/ OR LEGISLATION AS TOPIC/ OR LEGISLATION, MEDICAL/; 57677 results.
15. MEDLINE; exp JURISPRUDENCE/ OR exp LEGISLATION AS TOPIC/ OR exp LEGISLATION, MEDICAL/; 297490 results.
16. MEDLINE; 8 OR 9 OR 10 OR 11 OR 12 OR 13 OR 14 OR 15; 1869253 results.
17. MEDLINE; ONLINE SYSTEMS/; 7361 results.
18. MEDLINE; exp ONLINE SYSTEMS/; 13636 results.
19. MEDLINE; REMOTE CONSULTATION/; 3659 results.
20. MEDLINE; exp REMOTE CONSULTATION/; 3659 results.
21. MEDLINE; 17 OR 18 OR 19 OR 20; 17257 results.
22. MEDLINE; 7 AND 16 AND 21; 187 results.

DEVELOPMENT OF ONLINE CLINICAL CONSULTATION – RESULTS SERVICE

1. MEDLINE; COMMUNICATION/; 63000 results.
2. MEDLINE; exp COMMUNICATION/; 372562 results.
3. MEDLINE; 1 OR 2; 372562 results.
4. MEDLINE; (test AND result*).ti,ab; 588479 results.
5. MEDLINE; "investigation result*".ti,ab; 669 results.
6. MEDLINE; SEXUALLY TRANSMITTED DISEASES/di [di=Diagnosis]; 2854 results.
7. MEDLINE; 4 OR 5 OR 6; 591670 results.
8. MEDLINE; CELLULAR PHONE/; 4394 results.
9. MEDLINE; exp CELLULAR PHONE/; 4734 results.
10. MEDLINE; ELECTRONIC MAIL/ OR TEXT MESSAGING/; 2410 results.
11. MEDLINE; exp ELECTRONIC MAIL/ OR exp TEXT MESSAGING/; 2410 results.
12. MEDLINE; 8 OR 9 OR 10 OR 11; 6558 results.
13. MEDLINE; PATIENT SATISFACTION/; 60360 results.
14. MEDLINE; exp PATIENT SATISFACTION/; 62992 results.
15. MEDLINE; 13 OR 14; 62992 results.
16. MEDLINE; AMBULATORY CARE FACILITIES/; 12255 results.
17. MEDLINE; exp AMBULATORY CARE FACILITIES/; 44830 results.
18. MEDLINE; 16 OR 17; 44830 results.
19. MEDLINE; 3 AND 7 AND 12 AND 18; 2 results.
20. MEDLINE; 3 AND 7 AND 12 AND 15; 28 results.
21. MEDLINE; 3 AND 12 AND 18; 46 results.
22. MEDLINE; 3 AND 7 AND 12; 181 results.
23. MEDLINE; 3 AND 12 AND 15; 176 results.

DEVELOPMENT OF ONLINE CLINICAL CONSULTATION – PARTNER NOTIFICATION

1. MEDLINE; CONTACT TRACING/; 3426 results.
2. MEDLINE; exp CONTACT TRACING/; 3426 results.
3. MEDLINE; "Partner notif*".ti,ab; 762 results.
4. MEDLINE; 1 OR 2 OR 3; 3708 results.
5. MEDLINE; CHLAMYDIA TRACHOMATIS/; 11029 results.
6. MEDLINE; exp CHLAMYDIA TRACHOMATIS/; 11029 results.
7. MEDLINE; exp SEXUALLY TRANSMITTED DISEASES/; 291769 results.
8. MEDLINE; 5 OR 6 OR 7; 294501 results.
9. MEDLINE; exp METHODS/ OR exp COMMUNICATION METHODS, TOTAL/; 590469 results.
10. MEDLINE; exp PATIENT SATISFACTION/; 62992 results.
11. MEDLINE; 4 AND 8 AND 9; 24 results.
12. MEDLINE; 4 AND 8 AND 10; 27 results.
13. MEDLINE; exp ONLINE SYSTEMS/; 13636 results.
14. MEDLINE; 4 AND 8 AND 13; 1 results.

VALIDATION AND EVALUATION OF AN ONLINE CLINICAL CARE PATHWAY

1. MEDLINE; exp CRITICAL PATHWAYS/; 4613 results.
2. MEDLINE; exp CLINICAL PROTOCOLS/; 137360 results.
3. MEDLINE; 1 OR 2; 141839 results.
4. MEDLINE; exp EVALUATION STUDIES/; 206624 results.
5. MEDLINE; exp VALIDATION STUDIES/ OR exp VALIDATION STUDIES AS TOPIC/; 73376 results.
6. MEDLINE; 4 OR 5; 268111 results.
7. MEDLINE; exp ONLINE SYSTEMS/; 13636 results.
8. MEDLINE; exp REMOTE CONSULTATION/; 3659 results.
9. MEDLINE; 7 OR 8; 17257 results.
10. MEDLINE; 3 AND 6 AND 9; 1 results.
11. MEDLINE; 3 AND 6; 2270 results.
12. MEDLINE; exp INTERNET/; 54606 results.
13. MEDLINE; exp AMBULATORY CARE FACILITIES/; 44830 results.
14. MEDLINE; 11 AND 12; 10 results.
15. MEDLINE; 3 AND 9; 62 results.
16. MEDLINE; 3 AND 9 AND 13; 0 results.
17. MEDLINE; 3 AND 12 AND 13; 0 results.
18. MEDLINE; 3 AND 12; 206 results.

VALIDATION AND EVALUATION OF A RESULTS SERVICE

1. MEDLINE; ("Test result*" OR "Investigation result*").ti,ab; 35133 results.
2. MEDLINE; SEXUALLY TRANSMITTED DISEASES/di [di=Diagnosis]; 2854 results.
3. MEDLINE; 1 OR 2; 37912 results.
4. MEDLINE; exp EVALUATION STUDIES/ OR exp VALIDATION STUDIES/; 266686 results.
5. MEDLINE; exp VALIDATION STUDIES AS TOPIC/ OR exp EVALUATION STUDIES AS TOPIC/; 1070667 results.
6. MEDLINE; 4 OR 5; 1262586 results.
7. MEDLINE; exp ONLINE SYSTEMS/; 13636 results.
8. MEDLINE; exp REMOTE CONSULTATION/; 3659 results.
9. MEDLINE; exp INTERNET/; 54606 results.
10. MEDLINE; 7 OR 8 OR 9; 69309 results.
11. MEDLINE; exp TEXT MESSAGING/ OR exp CELLULAR PHONE/; 4734 results.
12. MEDLINE; exp ELECTRONIC MAIL/; 1957 results.
13. MEDLINE; 10 OR 11 OR 12; 74428 results.
14. MEDLINE; 3 AND 6 AND 13; 84 results.

VALIDATION AND EVALUATION OF ONLINE CLINICAL CONSULTATION

1. MEDLINE; exp DATA COLLECTION/; 1520880 results.
2. MEDLINE; exp HEALTH SURVEYS/; 426202 results.
3. MEDLINE; exp QUESTIONNAIRES/; 318342 results.
4. MEDLINE; exp MEDICAL HISTORY TAKING/; 18623 results.
5. MEDLINE; exp INTERVIEWS AS TOPIC/; 59269 results.
6. MEDLINE; exp DECISION MAKING/; 123969 results.
7. MEDLINE; exp DECISION SUPPORT SYSTEMS, CLINICAL/; 5235 results.
8. MEDLINE; exp EVALUATION STUDIES/; 206624 results.
9. MEDLINE; exp VALIDATION STUDIES/; 71818 results.
10. MEDLINE; exp EVALUATION STUDIES AS TOPIC/; 1070667 results.
11. MEDLINE; exp VALIDATION STUDIES AS TOPIC/; 1592 results.
12. MEDLINE; 8 OR 9 OR 10 OR 11; 1262586 results.
13. MEDLINE; exp ONLINE SYSTEMS/; 13636 results.
14. MEDLINE; exp REMOTE CONSULTATION/; 3659 results.
17. MEDLINE; 1 OR 2 OR 3 OR 4 OR 5 OR 6 OR 7; 1636466 results.
18. MEDLINE; 12 AND 16 AND 17; 3099 results.
19. MEDLINE; 13 OR 14; 17257 results.
20. MEDLINE; 12 AND 17 AND 19; 697 results.

21. MEDLINE; 20 [Limit to: English Language and Humans and Publication Year 1993-Current and (Age Groups All Adult 19 plus years or Adolescent 13 to 18 years)]; 243 results.

VALIDATION AND EVALUATION OF A PARTNER NOTIFICATION SERVICE

1. MEDLINE; exp EVALUATION STUDIES/; 206624 results.
2. MEDLINE; exp VALIDATION STUDIES/; 71818 results.
3. MEDLINE; exp EVALUATION STUDIES AS TOPIC/; 1070667 results.
4. MEDLINE; exp VALIDATION STUDIES AS TOPIC/; 1592 results.
5. MEDLINE; 1 OR 2 OR 3 OR 4; 1262586 results.
6. MEDLINE; exp ONLINE SYSTEMS/; 13636 results.
7. MEDLINE; exp REMOTE CONSULTATION/; 3659 results.
8. MEDLINE; 6 OR 7; 17257 results.
9. MEDLINE; exp CONTACT TRACING/; 3426 results.
10. MEDLINE; "Partner notif*".ti,ab; 762 results.
11. MEDLINE; 9 OR 10; 3708 results.
12. MEDLINE; 5 AND 8 AND 11; 1 results.
13. MEDLINE; exp INTERNET/; 54606 results.
14. MEDLINE; 5 AND 11 AND 13; 17 results.

VALIDATION AND EVALUATION OF AN ELECTRONIC PRESCRIBING SERVICE

1. MEDLINE; exp EVALUATION STUDIES/; 206624 results.
2. MEDLINE; exp VALIDATION STUDIES/; 71818 results.
3. MEDLINE; exp EVALUATION STUDIES AS TOPIC/; 1070667 results.
4. MEDLINE; exp VALIDATION STUDIES AS TOPIC/; 1592 results.
5. MEDLINE; 1 OR 2 OR 3 OR 4; 1262586 results.
6. MEDLINE; exp ONLINE SYSTEMS/; 13636 results.
7. MEDLINE; exp REMOTE CONSULTATION/; 3659 results.
13. MEDLINE; exp INTERNET/; 54606 results.
14. MEDLINE; 6 OR 7 OR 13; 69309 results.
15. MEDLINE; exp ELECTRONIC PRESCRIBING/; 557 results.
16. MEDLINE; exp MEDICAL ORDER ENTRY SYSTEMS/; 1613 results.
17. MEDLINE; exp DRUG THERAPY, COMPUTER-ASSISTED/; 1560 results.
18. MEDLINE; 15 OR 16 OR 17; 3411 results.
19. MEDLINE; 5 AND 14 AND 18; 22 results.

APPENDIX III – STUDY PROTOCOL

Full Title Can internet-based (*eSTI2*) clinical care pathways for people with genital chlamydial infection provide an acceptable and feasible alternative to routine care?

Short Title/Acronym *eSTI2* chlamydia clinical care pathway pilot study

Sponsor Barts Health NHS Trust

Mr Gerry Leonard

Head of Research Resources

Joint Research Management Office

5 Walden Street

London

E1 2EF

Phone: 020 7882 7260

Email: sponsorsrep@bartshealth.nhs.uk

REC Reference XXXX

Chief Investigator Dr. Claudia Estcourt

Reader in Sexual Health and HIV, Honorary Consultant

Blizard Institute

Barts and the London School of Medicine and Dentistry

Barts Sexual Health Centre

St Bartholomew's Hospital

West Smithfields

London EC1A 7BE

Tel: 020 7882 2316

c.s.estcourt@qmul.ac.uk

Research Sites Barts Health NHS Trust

St George's Healthcare NHS Trust eSTI2 Chlamydia Clinical Care Pathway Pilot Protocol V1. 07 06 13

P 2/25

Contents Page

Contents

1 GLOSSARY of Terms and Abbreviations	3
2 SIGNATURE PAGE	5
3 SUMMARY.....	6
4 INTRODUCTION AND RATIONALE FOR STUDY	7
5 STUDY OBJECTIVES	10
6 METHODOLOGY	11
6.1 Inclusion Criteria	11
6.2 Exclusion Criteria	11
6.3 Intervention Design	12
6.4 Recruitment and seeking consent	14
6.5 Follow-up of participants	16
6.6 Procedure for Collecting Data	16
6.7 Subject withdrawal	17
6.8 End of Study Definition	17
7 STATISTICAL CONSIDERATIONS	17
8 ETHICS	19
9 CONFIDENTIALITY AND DISSEMINATION	20
10 SAFETY CONSIDERATIONS	20
11 DATA HANDLING AND RECORD KEEPING	21
12 LABORATORIES	22
13 MONITORING andAUDITING	22
14 STUDY COMMITTEES	22
15 FINANCE AND FUNDING	23
16 INDEMNITY.....	23

17 DISSEMINATION OF RESEARCH FINDINGS:	23
18 REFERENCES	24
19 APPENDICES	
Appendix I – GUM patient information leaflets	
Appendix II – GUM clinic posters	
Appendix III – NCSP patient information leaflet	
Appendix IV – Qualitative interview – Experience and Acceptability	
Appendix V – Qualitative interview - Usability	
Appendix VI – Service evaluation questions	eSTI2 Chlamydia
Clinical Care Pathway Pilot Protocol V1. 07 06 13 P 3/25	

1 GLOSSARY of Terms and Abbreviations

AE Adverse Event

AR Adverse Reaction

ASR Annual Safety Report

BASHH British Association for Sexual Health and HIV

CA Competent Authority

Checkurself National Chlamydia Screening Programme website through which people may order a home sampling kit for Chlamydia

Chlamydia *Chlamydia trachomatis* (*C.trachomatis*), the commonest bacterial STI in the UK

CI Chief Investigator

CRF Case Report Form

CRO Contract Research Organisation

DMC Data Monitoring Committee

EC European Commission

eHealth ‘The use of emerging information and communications technology, especially the internet, to improve or enable health and healthcare’ [1].

eSexual Health Clinic Online clinical management system for people with chlamydia

eSTI2 Electronic Self-Testing Instruments for Sexually Transmitted Infections

GAfREC Governance Arrangements for NHS Research Ethics Committees

GCP Good Clinical Practice

GMC General Medical Council

GUM Genitourinary Medicine

ICF Informed Consent Form

Index patient individual with chlamydial infection JRMO Joint Research Management Office

NCSP National Chlamydia Screening Programme: Public Health England’s screening program for people under 25 years

NHS REC National Health Service Research Ethics Committee

NHS RandD National Health Service Research and Development

NICE National Institute for Health and Care Excellence

Participant An individual who takes part in clinical research eSTI2 Chlamydia Clinical Care Pathway

Pilot Protocol V1. 07 06 13 P 4/25

Partner Notification The process by which those exposed to an STI are contacted and offered testing and treatment

PI Principal Investigator

PIL Participant Information Leaflet

QA Quality Assurance

QC Quality Control

RCT Randomised Controlled Trial

REC Research Ethics Committee

SAE Serious Adverse Event

Sex partner Sexual partner of index patient

SDV Source Document Verification

Sexual Health Adviser Health care professional responsible for partner notification

SOP Standard Operating Procedure

SMS Short messaging service (text message)

SSA Site Specific Assessment

STI Sexually Transmitted Infection

TDL The Doctors' Laboratory

TMG Trial Management Group

TSC Trial Steering Committee eSTI2 Chlamydia Clinical Care Pathway Pilot Protocol V1. 07 06 13 P

5/25

2 SIGNATURE PAGE

Chief Investigator Agreement

The clinical study as detailed within this research protocol (**Version 1, Dated 07 Jun 13**), or any subsequent amendments will be conducted in accordance with the Research Governance Framework for Health and Social Care (2005), the World Medical Association Declaration of Helsinki (1996) and the current applicable regulatory requirements and any subsequent amendments of the appropriate regulations.

Chief Investigator Name: Dr. Claudia Estcourt

Chief Investigator Site: Barts Health NHS Trust

Signature and Date:

Principal Investigator Agreement (if different from Chief investigator)

The clinical study as detailed within this research protocol (**Version 1, Dated 07 Jun 13**), or any subsequent amendments will be conducted in accordance with the Research Governance Framework for Health and Social Care (2005), the World Medical Association Declaration of Helsinki (1996) and the current applicable regulatory requirements and any subsequent amendments of the appropriate regulations.

Principal Investigator Name: as above

Principal Investigator Site:

Signature and Date: eSTI2 Chlamydia Clinical Care Pathway Pilot Protocol V1. 07 06 13 P 6/25

3 SUMMARY Short Title

eSTI2 chlamydia clinical care pathway pilot study

Methodology

Prospective, mixed-method (quantitative and qualitative), non-randomised, exploratory pilot study to develop and

	evaluate a novel clinical care pathway.
Research Sites	Barts Health NHS Trust, St George's Healthcare NHS Trust
Objectives/Aims	<p>To develop, implement and evaluate an electronic clinical care pathway <i>“eSTI2 chlamydia clinical care pathway”</i> for management of people with genital chlamydia infection and to explore whether it can provide an acceptable, and feasible alternative to routine care.</p> <p>This study forms part of the UKCRC funded <i>eSTI2</i> consortium (www.esti2.org.uk) which aims to develop and evaluate a rapid diagnostic self-testing device for Sexually Transmitted Infections (STIs) integrated with an electronic clinical care pathway.</p> <p><i>This study focusses on the clinical care pathway, from test result to treatment, ahead of development of a new eSTI2 diagnostic device,</i> and will inform development of a protocol for a future substantive trial which will include <i>both</i> diagnostic device <i>and</i> care pathway.</p>
Total Number of Participants/Patients	420

Main Inclusion Criteria

The *eSTI2 chlamydia clinical care pathway*

will be explored with people from two different patient groups:

1. People from participating Genitourinary Medicine (GUM) clinics, aged 16 or over, who have tested positive for genital chlamydia and who have not yet received treatment.

2. People from participating National Chlamydia Screening Programme internet-based testing areas, aged 16 or over, who have tested positive for genital chlamydia using a postal chlamydia test and who have not yet received treatment.

Statistical Methodology and Analysis (if applicable)

Quantitative analysis to quantify the

primary outcome: proportion of chlamydia positive participants who receive

appropriate treatment in each patient

group and calculate a 95% confidence

interval so that non-inferiority

with respect to current pathways can be

assessed. Qualitative methods used will

include semi-structured interviews with a

sub-section of participants. Thematic

analysis will be conducted.

Proposed Start Date 1st August 2013

Proposed End Date 31st July 2016

INTRODUCTION AND RATIONALE FOR STUDY

Can internet-based (*eSTI2*) clinical care pathways for people with genital chlamydial infection provide an acceptable and feasible alternative to routine care?

Background

Effective control of sexually transmitted infections (STIs) is challenged by inadequate access to prompt diagnosis and treatment for patients and their sex partners and relatively poor community STI surveillance to inform targeting of public health interventions. Many perceived barriers to testing in current traditional and outreach settings have been described [2-3]. These include stigma associated with attending sexual health services, geographical distance and poor transport links to clinical services. A fresh approach to service provision, removing some of these real and perceived barriers may provide an important strategy to widen access to testing and treatment, ultimately improving STI control within a population.

Point of care (PoC) rapid testing for STI diagnosis may address some of these challenges by enabling diagnosis of infection, treatment and partner notification, the process in which a person exposed to an STI is informed and offered testing and treatment, within a very short time frame. Rapid test and PoC technologies have also the potential to be used in novel settings such as people's homes (home or self-sampling/self-testing) and enhance targeted STI screening programmes aimed at reducing long term morbidity such as the National Chlamydia Screening Programme (NCSP) [4]. However, currently available licensed PoC tests for STIs are either inaccurate or potentially too expensive for health care providers and none are currently licenced for home testing in the UK. In some areas,

internet-requested STI sampling is available however, this entails a person providing a urine or swab sample and mailing it back for conventional laboratory based testing, followed by referral to traditional health care services for treatment.

eSTI2 Consortium

The *eSTI2 chlamydia clinical care pathway* pilot study sits within the *eSTI2* Consortium [5], which is a multidisciplinary collaboration of six major UK institutions funded by the UKCRC, (Medical Research Council [MRC] G0901608) to deliver a five year program of research which aims to reduce the impact of STIs by developing, evaluating and deploying simple to use, rapid, accurate, polymicrobial and affordable micro-diagnostics that can be networked through mobile phones. These diagnostics may be deployed as self-tests (home tests), or within more traditional clinical settings.

Clinical management and follow up of individuals who test using these technologies will be possible using remote management pathways (*eSTI2 clinical care pathway*) within “eSexual Health clinics”, embedded within NHS sexual health services. This could increase the treatment rate in people who test positive for STIs and reduce delays in accessing effective treatment.

The innovative nature of the remote management pathway means that extensive evaluation is necessary before trials of a putative *eSTI2* diagnostic device are implemented. Therefore, we will undertake this exploratory study to further develop, implement and evaluate the *eSTI2 clinical care pathway* (see below) with a view to detailed process evaluation and outcome estimation sufficient to allow power calculations for a future definitive trial in which the *eSTI2* device and *eSTI2 clinical care pathway* are integrated within a complex intervention.

Preclinical Data: work in preparation for the study

The *eSTI2* research team has undertaken extensive preparatory research to inform initial development of the *eSTI2 chlamydia clinical care pathway* as part of the funded research program, in line with the MRC’s guidance on development of complex interventions [6].

This includes:

1. ***Qualitative study of young people's views on the acceptability of remote home testing for STIs and the proposed eSTI2 clinical care pathways***, using semi-structured interviews with young people aged 16-24 (potential users). Findings strongly supported eSTI2 approaches to STI testing and clinical management and informed early development of the internet and web-app based program (UCL ethics ref: 3490/001).

2. ***Qualitative study of young people's views of content and format of our proposed "eSexual Health Clinic"*** which will house the clinical management pathway for people diagnosed with *C.trachomatis*. This study used focus group methodology in different settings to explore the optimal human technology interface (Brunel Research Ethics Committee, 13.9.12).

3. ***Review of the regulatory, data protection, and professional guidance relevant to developing and implementing ehealth clinical pathways within an NHS context***. This extensive review of legal, regulatory, data protection, ethical, and perceptual barriers to implementation of *eSTI2 chlamydia clinical care pathways* included a comprehensive literature and policy review and consultation with legal experts (Professor R Ashcroft, Professor of Biomedical ethics and Law, Queen Mary University of London), and the trial Sponsor Trust's data protection lead. Refinement of the pathway will be undertaken in this study to ensure it complies with these wide ranging regulations.

4. ***Development of the public health surveillance system***. Work from our *eSTI2* Public Health England based researchers has created a robust method of ensuring that appropriate data [7] is available for routine surveillance purposes from the *eSTI2 chlamydia clinical care pathways*, and is collected in a way which complies with appropriate data protection guidance.

5. ***Previous work from several eSTI2 researchers on novel forms of partner notification*** has enabled us to adopt the validated technologies used in the MRC funded APT trial [8] for use in the *eSTI2* sex partner care pathway.

We have integrated findings from the above elements of the "pre-clinical" phase to develop a ***prototype eSTI2 chlamydia clinical care pathway***, which is described in detail in section 6.3.

Briefly, chlamydia-positive participants, *in addition to the standard ways of accessing treatment*, will be offered the online *eSTI2 chlamydia clinical care pathway*, within our eSexual health clinic, which can facilitate rapid treatment and partner notification using an online clinical consultation. Providing it is safe to do so, participants will be able to choose a convenient participating community pharmacy from which to collect their treatment. An authorisation will be emailed, using NHS.net, from the eSexual Health Clinic to the chosen pharmacy and pre packed antibiotics, supplied to the pharmacy as part of the research trial, will be dispensed by the pharmacist. In line with the General Medical Council (GMC) [9] prescribing guidelines and the BASHH (British Association for Sexual Health and HIV) guidelines [10], the participant will receive information on the common side effects of the medication, what to do if they have an adverse reaction and advice on further management, including health promotion.

The *eSTI2 chlamydia clinical care pathway* is supported by a clinical telephone helpline, staffed by research clinical sexual health advisers from the study GUM clinics, who can provide advice and / or facilitate access to traditional care at any stage of the process.

Potential benefits

At the individual level, the potential benefits of the *eSTI2 chlamydia clinical care pathways* centre on making it easier for people with genital chlamydia to receive appropriate management in a way that they find easy, acceptable and feasible. At a public health level, the major advantage would be to increase the proportion of people with genital chlamydia who receive appropriate treatment. This could lead to a reduction in complications of untreated *C. trachomatis* and improve health outcomes and reduce onward transmission, leading to a reduction in community chlamydial disease, and a reduction in the associated economic burden. From an economics perspective, the *eSTI2 chlamydia clinical care pathways* have potential to offer a more cost-effective option than existing NHS treatment and partner notification service delivery models

In short, *eSTI2 chlamydia clinical care pathways* could: increase access to treatment; reduce time to achieve treatment; increase acceptability of treatment; widen patient choice; reduce community

burden of chlamydial disease; provide a cost-effective service delivery model and reduce the economic burden associated with chlamydial disease.

Risks from participating in this study

After careful consideration of a wide range of clinical, ethical and data protection issues, we do not believe that there are any significant risks to participants in the *eSTI2 chlamydia clinical care pathways* study. Please also see *Section 10. Safety Considerations*.

5 STUDY OBJECTIVES

Primary Objective:

To determine the acceptability and feasibility of the *eSTI2 chlamydia clinical care pathway* to people who undergo a genital chlamydia test in different settings, which reflect the potential future use of a new *eSTI2* point of care/ home testing STI diagnostic device, fully integrated within NHS services

Secondary Objectives:

- To obtain preliminary evidence of effectiveness of the *eSTI2 chlamydia clinical care pathway* compared with standard care to inform a future substantive trial.
- To determine the acceptability and feasibility of the *eSTI2 chlamydia clinical care pathway* to sex partners of people diagnosed with genital chlamydial infection.
- To assess the effectiveness of the *eSTI2 chlamydia clinical care pathway* compared to costs and outcomes of current NHS practice in GUM clinics and the NCSP postal testing services in England.
- To provide data to be fed into an economic simulation model to be developed for the *eSTI2 chlamydia clinical care pathway*.

Primary Outcome Measure

The proportion of people who test positive for genital *C.trachomatis* infection (index patients) and the proportion of those who are managed through the *eSTI2 clinical care pathway* who receive appropriate clinical management*.

*as defined by BASHH National Standards for management of genital *C.trachomatis* [10].

Secondary Outcome Measures

Quantitative:

- Proportion of index patients who receive antibiotic treatment solely through the electronic element of the *eSTI2 chlamydia clinical care pathway*.
- Time from index patient receiving diagnosis to receiving appropriate treatment.
- Proportion of sex partners treated.
- Time from index patient receiving diagnosis to sex partner receiving appropriate treatment.
- Indicative *eSTI2 chlamydia clinical care pathway* costs
- Cost-consequence analysis of *eSTI2 chlamydia clinical care pathway*

Qualitative:

- Acceptability and feasibility of *eSTI2 chlamydia clinical care pathways* to index patients
- Acceptability and feasibility of *eSTI2 chlamydia clinical care pathways* to sex partners *eSTI2*

Chlamydia Clinical Care Pathway Pilot Protocol V1. 07 06 13 P 11/25

6 METHODOLOGY

This study forms part of the UKCRC funded *eSTI2* consortium (www.esti2.org.uk) [5] which aims to develop and evaluate a rapid diagnostic self-testing device for STIs integrated with an electronic clinical care pathway. *This study focusses on the chlamydia clinical care pathway, from test result to treatment, ahead of development of a new eSTI2 diagnostic device*, and will inform development of a protocol for a future substantive trial which will include *both* diagnostic device *and* care pathway.

There is no currently available suitable alternative testing device, which we could use in this exploratory study of the *eSTI2 chlamydia clinical care pathway*, to simulate the novel *eSTI2* point of care diagnostic test being developed in the consortium. For this reason we will include standard diagnostic tests in routine NHS use but explore the clinical pathway with participants from two contrasting service user groups:

- a. **Genitourinary Medicine (GUM) clinic attenders**, to explore the *eSTI2 chlamydia clinical care pathway* with a group of people with high rates of chlamydia.
- b. **National Chlamydia Screening Program (NCSP) Checkurself website** [11] to explore the *eSTI2 chlamydia clinical care pathway* in a group of people who have already shown acceptability of using the internet to request a postal chlamydia test.

6.1 Inclusion Criteria

a. **GUM clinics: *Barts Health NHS Trust (Ambrose King Centre and Barts Sexual Health Centre), St George's Healthcare NHS Trust (Courtyard Clinic)***

- Patients who have tested positive for genital *C.trachomatis*
- Patients 16 years of age and over
- Patients who consent to the study

Patients who are able to read and understand English

b. NCSP Checkurself website based testing areas: Bexley, Bromley, Croydon, *Greenwich, Lambeth and Southwark, Lewisham, Sutton and Merton, Wandsworth.*

- Patients who have tested positive for genital *C.trachomatis* using a test accessed through the NCSP Checkurself internet based postal testing website
- Patients 16 years of age and over
- Patients who consent to the study
- Patients who are able to read and understand English

6.2 Exclusion Criteria

a. GUM clinics

- Patients who are simultaneously diagnosed with another STI (as they will require more complex management and a face-to-face consultation)
- Patients who have already received treatment for *C.trachomatis*
- Patients diagnosed with rectal *C.trachomatis*
- Patients who have not provided a mobile telephone number
- Patients who do not meet the inclusion criteria.

b. NCSP Checkurself website

- Patients who are simultaneously diagnosed with another STI (as they will require more complex management and a face-to-face consultation)
- Patients who have already received treatment for *C.trachomatis*
- Patients who have not provided a mobile telephone number
- Patients who do not meet the inclusion criteria.

6.3. Intervention Design

The central components of the prototype *eSTI2 chlamydia clinical care pathway* we are developing and evaluating are the same for participants from both recruitment settings. Therefore, we will first describe the prototype *eSTI2 chlamydia clinical care pathway* and all subsequent participant evaluation, as this is common to all settings, then we will describe how participants from each setting enter the care pathway.

6.3.1 Prototype eSTI2 chlamydia clinical care pathway

The *eSTI2 chlamydia clinical care pathway* offers people with a positive *C.trachomatis* test the opportunity to undergo an online clinical consultation with the aim of obtaining appropriate antibiotic treatment. Providing it is safe to do so, participants will be able to choose a convenient participating community pharmacy from which to collect their treatment. Treatment will be authorised by the eSexual Health Clinic and the antibiotics will be dispensed by the pharmacist at a participating pharmacy. Participants will access the *eSTI2 chlamydia clinical care pathway* using a web-application specifically designed as part of the study.

The *eSTI2 chlamydia clinical care pathway* also has a partner notification function (see note below) such that sex partners will be able to access the online clinical consultation, and obtain treatment, via the *eSTI2 chlamydia clinical care pathway* in the same way described above.

Note: partner notification is the process by which a person with an STI notifies their relevant sex partners that they have been exposed to an STI and that they need treatment. Current UK guidance recommends “empirical treatment” of sex partners ie that sex partners should receive treatment whether or not they choose to be tested for the STI in question and irrespective of the test result [8]. The following diagram shows how the prototype *eSTI2 chlamydia clinical care pathway* fits within the eSexual Health Clinic.

6.3.2 eSTI2 Chlamydia Clinical Management within the eSexual Health Clinic

Footnotes:

- i. The *eSTI2 chlamydia clinical care pathway* is supported at all stages by a research clinical sexual health adviser-led telephone clinical helpline based in the Barts Health NHS Trust study GUM clinic.
- ii. At any stage, a participant may decide not to proceed with the *eSTI2 chlamydia clinical care pathway*, in which case his/her care will continue according to routine care pathways.
- iii. *eSTI2 chlamydia clinical care pathway online clinical consultation*.

The content of the online clinical consultation will be based on questions used in routine practice, a previous MRC-funded exploratory trial of remote patient assessment [6] and national guidelines for sexual history taking [10]. All data items routinely collected in traditional consultations for public health surveillance purposes [7] will be included. Participants for whom the online clinical care pathway is unsuitable will be directed immediately away from the online pathway to the clinical helpline so that their care can be individually facilitated by the research clinical sexual health adviser by arranging a “fast track” clinical appointment for face to face assessment in one of our study GUM services. Evidence from previous studies [8] suggests that this is a robust method of ensuring that patients with more complex clinical presentations achieve appropriate care quickly and with high levels of satisfaction.

If a patient completes the online clinical consultation and it is safe to do so, an authorisation will be generated from the eSexual Health Clinic to a participating pharmacy and pre-packed antibiotics, supplied to the pharmacy as part of the research study, will be dispensed by the pharmacist.

v. *Partner notification eSTI2 chlamydia clinical care pathway*: National guidance from both specialist organisations [8] and National Institute for Health and Care Excellence (NICE) [12] states that partner notification is an integral part of STI treatment and should be included in all treatment discussions with people with acute bacterial STIs, such as chlamydia. To comply with this guidance we need to provide a method of partner notification within the *eSTI2 chlamydia clinical care pathway*. We will adapt the APT partner notification web tool, developed as part of a previous MRC-funded study [8] (Research Ethics ref:06/Q0101/3), to enable relevant sex partners of people with chlamydia on the *eSTI2 chlamydia clinical care pathway* to access their clinical assessment and treatment in the same way.

As for the index patient, sex partners accessing the *eSTI2 chlamydia clinical care pathway* will be supported at all stages by the health adviser-led clinical helpline. At any stage, a sex partner may decide not to proceed with the clinical pathway. In which case his/her care will continue according to routine standards of care

6.3.3 Piloting of the Intervention

Prior to commencement of the recruitment phase, we will pilot the *eSTI2 chlamydia clinical care pathway* to test its safety and efficacy. We will use the medical histories from clinical records from previously attending Barts Health Sexual Health Services patients who would have met the study inclusion criteria, to develop simulated patient scenarios.

The clinic sexual health advisers will identify the clinical notes of appropriate patients, and remove all patient identifiable information leaving only the clinical information. Two *eSTI2* researchers and a research clinical sexual health adviser will then use the clinical information provided in the case notes to answer the health questions on the online clinical pathway to ensure the outcome, i.e.

whether or not it is safe to prescribe Azithromycin matches the clinical decision made during the face-face consultation in clinic.

6.4 Recruitment and seeking consent

There will be 3 steps to this process, which are explained below:

6.4.1. Patient information

a.GUM Clinic patients:

During the patient registration process at the GUM clinic, receptionists routinely provide information explaining how patients will receive their *C.trachomatis* result. For many patients this will be by text message, as is common practice in NHS GUM services. At this time patients will be informed by the receptionists that the clinic is taking part in a research study looking at how patients can get antibiotic treatment without coming back to the GUM clinic if their *C.trachomatis* result is positive, and for further explanation they will be asked to read the Patient information leaflet (PIL) given to them (please see Appendix I). There will also be posters within the GUM clinic explaining the research study (please see Appendix II).

b. NCSP Patients:

People from participating local authorities (see section 6.1.b), who request a *C.trachomatis* test kit via the NHS commissioned postal chlamydia test requesting service “Checkurself “ website <https://www.checkurself.org.uk/> [11] will receive a PIL inside the test pack sent out to them (please see Appendix III).

6.4.2. Identification of eligible patients

a.GUM Clinic patients:

On a daily basis, for the duration of the study, sexual health advisers from the GUM clinics will identify all eligible patients and will send them individually a text message saying that their results are ready and giving them a link through which they can access their results on the web tool, using a unique identifying number given to them at registration and their date of birth.

b.NCSP patients:

Collaborating NCSP areas have a contract with a diagnostic laboratory, The Doctors Laboratory (TDL), London, W1T 4EU, to process and send out the results of patient's chlamydia tests. For the duration of the study, on a daily basis, TDL will identify all eligible patients and will send them individually a text message saying that their results are ready and giving them a link through which they can access their results on the web tool, using a unique identifying number provided on the test form, and their date of birth.

6.4.3. Consent**GUM clinic patients and NCSP patients:**

When people have accessed their result by logging on to the web-app (*please see section 6.6.1 below*), which may be accessed on a smartphone or computer, they will see that they have a positive *C. trachomatis* result. They will then be given information about chlamydia and then provided with options for accessing treatment. This will include the opportunity to get treatment using the *eSTI2 chlamydia clinical care pathway*. If they choose the *eSTI2 chlamydia clinical care pathway*, they will first be directed to the consent page which includes a second opportunity to read the PIL via a link on the web page. Once they have consented, they will be directed onto the online clinical consultation and will become patients of Barts Health NHS Trust Sexual Health Services.

Qualitative interviews:

There is information on the PIL explaining that participants may be asked to participate in an online telephone discussion about their views and opinions of the *eSTI2 chlamydia clinical care pathway*. Participants in the research study will be followed up by telephone by clinical sexual health advisers, as per routine care, two weeks following their online clinical consultation to ascertain adherence to treatment and partner notification outcomes. At this time the clinical sexual health adviser will ask a sub section of patients, based on the researchers' sampling criteria, if they would like to take part in a telephone discussion with a researcher who is interested in getting their views and opinions of the *eSTI2 chlamydia clinical care pathway*, whether or not they received all of their care this way. This

will include people who attend clinic for reasons of preference or because the eSTI2 chlamydia online clinical consultation indicated that it was inappropriate to provide treatment remotely. If patients agree, the clinical sexual health adviser will agree a time that is convenient to the participant for the researcher to telephone. The researcher will obtain verbal consent at that point. We will conduct two sets of interviews with different participants. One set will focus on the process and content of the *eSTI2 chlamydia clinical care pathway* (please see Appendix IV) and the second set will focus on the human technology interface aspects of the eSexual Health Clinic (please see Appendix V).

6.5 Follow-up of participants

All *C.trachomatis* positive participants will receive clinical follow up in line with national recommendations [10]. The clinical follow up and the additional research follow up activities are detailed below:

Two weeks after the patient is sent his/her results by text, in line with national recommendations, the research clinical sexual health adviser will telephone all participants with positive *C.trachomatis* tests to ensure that treatment has occurred and partner notification has been initiated / completed (as described above in section 6.4.3). They will also ask a limited number of service evaluation questions (please see Appendix VI) about the *eSTI2 chlamydia clinical care pathway*, which will be recorded on the study database (please see section 6.6.1 below).

6.6 Procedure for Collecting Data

6.6.1 Web-application and study database

A web-application linked to the study database will be created according to the needs of the *eSTI2 chlamydia clinical care pathway*. A web-based front end tool (web tool) for the database will also be created which will enable the research team to integrate and access the data according to access principles described in section 8.5. The commissioned company chosen will adhere to the requirements of the Department of Health for all commercial third parties processing personal

identifiable data on behalf of NHS organisations and they will complete the Information Governance Toolkit. This will be achieved in the following ways:

I. The database will be commissioned in accordance with current NHS standards for data storage and transfer, under the oversight of NHS information officers in relevant NHS trusts. Data will be stored on secure servers with access controls. Only appropriate clinicians will have access to personal identifiable information.

II. Collecting the minimum number of data items for appropriate clinical care and justifying the intended use of each data item stored or transferred.

III. A steering group will oversee the commissioning and specification of the web tool to be used for data transfer. The steering group will include at least one member with experience of successfully commissioning electronic health records and a good understanding of relevant legislation and web security issues, and will include Barts Health NHS Trust Data protection lead.

IV. Confidentiality: Only essential personal information will be obtained for the purpose of the study. All information will be obtained with strict adherence to the Caldicott principles of confidentiality as outlined in the Caldicott report 1997 and referred for permission to the relevant NHS data protection officer and Caldicott guardian at every stage. In addition we will make sure that all staff will receive training on the use of the web tool, and the web tool will have appropriate security levels set up, including access controls so that sensitive information can be seen only by the clinicians.

V. No information will be collected or stored on the web-app or on the users' mobile phones or computers. All the data captured through the web-app will be transmitted, processed and stored on the server.

6.6.2 Qualitative interviews

Semi-structured interviews with participants will be audio recorded. Recordings will be securely stored on password protected computers within a locked office within the Barts Health NHS Trust research team and deleted after the transcription has been checked. Transcripts will be kept in password protected computer files, and all potentially identifiable information (e.g. names) omitted from the transcripts.

6.7 Subject withdrawal (including data collection / retention for withdrawn participants)

All participants will be informed during the consent process that they can withdraw from the study at any point by contacting the Chief Investigator. Should the participant request to be withdrawn from the study, the information already gathered would not be used for research purposes.

However, once consented, participants will become patients of Barts Health NHS Trust. Therefore, essential patient details will be retained irrespective of research study participation status as per standard clinical care. In addition, and as per standard practice, patients will be contacted for clinical care purposes (e.g. routine clinical follow ups, partner notification) irrespective of their research study participation status. This information will not be accessible to researchers.

6.8 End of Study Definition

The end of the study will be when the final analysis (statistical or qualitative, whichever is later) has been performed.

7 STATISTICAL CONSIDERATIONS

7.1 Sample size

In total we aim to recruit the following number of participants:

1: 121-164 index patients from GUM clinics

2: 108-156 index patients from NCSP internet test request sites

3: 40-60 index patients purposively sampled from across both study arms for qualitative follow up interviews

4: 100 sex partners who have chosen to access care through eSTI2 *chlamydia clinical care* pathway

7.1.1 Justifications for sample size

a. GUM clinic setting

In assessing the performance of the *eSTI2 clinical care pathways* we will examine the proportion who receive appropriate treatment amongst those offered the *eSTI2 clinical care pathways*. The current proportion of GUM patients who receive appropriate treatment in the absence of the *eSTI2 clinical care pathways* is considered to be around 98% [13]. We aim to demonstrate non-inferiority of the *eSTI2 clinical pathway* i.e. that treatment outcomes for participants who receive treatment via *eSTI2 clinical care pathway* are better or only slightly worse than 98% [i.e. non-inferior].

If the true proportion of patients who are offered the *eSTI2 clinical care pathways* and receive appropriate treatment is in fact 99%, then 121 patients will provide 80% power to demonstrate that the proportion is greater than 94%, and 164 patients will provide 80% power to show the proportion is greater than 95%. Assuming 50% uptake, we will aim to offer the *eSTI2 clinical care pathways* to 242-328 eligible patients

b. NCSP Checkurself website

The current proportion of NCSP patients who receive appropriate treatment in the absence of *eSTI2 clinical care pathways* is considered to be around 88% [14]. We aim to demonstrate non-inferiority of the *eSTI2 clinical care pathway* i.e. that treatment outcomes for participants who receive treatment via *eSTI2 clinical care pathway* are better or only slightly worse than 88% [i.e. non-inferior]. Assuming that the *eSTI2* treatment rate will be just a little higher than NCSP (at 90%), 156 participants will provide 80% power to show it is greater than 82%, and 108 participants to show it is greater than 80%, i.e. to demonstrate non-inferiority to current NCSP treatment rates (88%).

Assuming 50% uptake, we aim to offer the study to 216-312 eligible patients.

7.2 Method of Analysis

7.2.1 Statistical methods

The primary outcome (appropriate clinical management through the *eSTI2 clinical care pathway*) is binary. The proportion with the primary outcome will be reported for each setting with a 95% confidence interval, which will be used to establish non-inferiority or otherwise. Associations with the primary outcome will be tested using chi-squared tests, and odds ratios with 95% confidence intervals will be reported. Multiple factors can be examined using logistic regression leading to adjusted odds ratios with 95% confidence intervals. Statistical analyses will be performed using a statistical software package by members of the research team, under the supervision of the trial statistician (Dr Andrew Copas, UCL).

Qualitative follow up interviews will be analysed thematically. Recurring themes and concepts will be identified and applied systematically to the transcripts. At least two researchers experienced in qualitative research will undertake analysis, and reliability will be enhanced by double coding a subset of transcripts and comparing inter-rater reliability. **8 ETHICS**

The study will be carried out in accordance with the ethical principles in the Research Governance Framework for Health and Social Care, Second Edition, 2005 and its subsequent amendments as applicable and applicable legal and regulatory requirements. All study researchers will have had up to date Good Clinical Practice (GCP) training prior to study start.

8.1 Safe Prescribing

Due to the novel nature of the *eSTI2 chlamydia clinical care pathway* we have conducted a literature review to identify, and thereby address, the legal, regulatory, ethical and perceptual barriers to implementing an eHealth STI clinical care pathway. In addition, we have drawn on the experience of the APT study [8], which also used a novel method of authorising antibiotic treatment. We have followed the GMC Good Prescribing Guidelines [9], which contain explicit guidance on remote prescribing and we will ensure that prescribing within the eSTI2 model satisfies all the necessary conditions. We will conduct extensive evaluation of the online clinical consultation prior to it being used in the exploratory study to ensure that we are satisfied that the web tool appropriately identifies patients for whom it would not be safe to manage via the online clinical care pathway. We

have robust processes in place to fast track such patients quickly for management in conventional health care settings.

8.2 Informed consent and withdrawal of consent

Participants will be made aware that the *eSTI2 chlamydia clinical care pathway* is an *additional* means of accessing treatment and that all routine alternatives are available to them should they prefer not to participate or withdraw at any stage after consenting to participate. Participants can withdraw at any stage without compromise to any aspect of their medical care.

8.3 Patient Support

A clinical helpline, staffed by specialist sexual health advisers from the Barts Health NHS Trust study clinic is available throughout the study should a participant require advice, psychological support or reassurance. This helpline is also the mechanism for facilitating rapid referral into traditional services for people for whom the *eSTI2 chlamydia clinical care pathway* is not medically appropriate. Work from members of the research team has demonstrated, in another study which used a similar clinical helpline, that people valued this highly and that it was extremely effective in moving people rapidly into appropriate care [8].

8.4 Duty of Care

We are approaching the issue of Duty of Care using parallels to the traditional context. Patients recruited through Barts Health sexual health services remain patients of Barts Health NHS Trust and so there is no change in duty of care. Patients who are recruited from St George's NHS Healthcare Trust sexual health services become patients of Barts Health NHS Trust as soon as they consent to the study and thus Barts Health NHS Trust assumes duty of care from that point. Barts Health NHS Trust will also assume duty of care for all people who test positive for *C.trachomatis* via the Checkyourself website testing as soon as they engage with the *eSTI2 chlamydia clinical care pathway* / eSexual Health Clinic.

8.5 Data Management

The web tool will be commissioned in accordance with current NHS standards for data storage and transfer. Data will be stored on secure servers with access controls. Only appropriate clinicians will have access to patient identifiable information.

- The minimum number of data items will be collected for appropriate clinical care and we will justify the intended use of each data item stored or transferred.
- The steering group will oversee the commissioning and specification of the web tool to be used for data transfer. The steering group will ensure that at least one member will have experience of successfully commissioning electronic health records and has a good understanding of relevant legislation and web security issues.
- Confidentiality: Only essential personal information will be obtained for the purpose of the study. All information will be obtained with strict adherence to the Caldicott principles of confidentiality as outlined in the Caldicott report 1997 and referred for permission to the relevant NHS data protection officer and Caldicott guardian at every stage. In addition we will make sure that all staff will receive training on the use of the web tool, and the web tool will have appropriate security levels set up, including access controls so that sensitive information can be seen only by the clinicians.
- The web app developed for the study is just an interface for the web tool. No information will be collected or stored on the app.

8.6 Conflict of interest

There are no known conflicts of interest.

9 CONFIDENTIALITY AND DISSEMINATION

At the end of the study, the findings will be disseminated to the health services and biomedical community through conference communications and publication in peer-reviewed, open access, scientific press. Direct quotations from participants will be altered as appropriate so that they are not attributable to the individual.

10 SAFETY CONSIDERATIONS

10.1 Participant safety

Oral Azithromycin 1g is the nationally recommended first line treatment for uncomplicated genital chlamydia [10] and will be used in the study. It is well tolerated and has low allergenicity. All participants requiring treatment will undergo a detailed clinical assessment to determine whether the treatment is appropriate and treatment will only be provided if it is medically appropriate. Of note, Azithromycin 1g has been used in the USA in several large trials of patient delivered partner therapy in which people with chlamydia are given doses of Azithromycin to take to their partners without an interceding medical assessment of the sex partner. In over 2000 doses given, there were no adverse reactions or safety concerns [15,16]. In line with the GMC prescribing guidelines [9] and the BASHH guidelines [10], the participant will receive information on the common side effects of the medication, what to do if they have an adverse reaction and advice on further management, including health promotion.

Clinical support will be available for the duration of the study in the form of a dedicated clinical helpline staffed by a study clinic-based sexual health advisor who will be able to deal with queries or concerns about the research and/or any clinical matters. This has been shown previously to afford excellent clinical outcomes and high levels of patient satisfaction [8].

10.2 Research staff security

The risk to staff will be minimal. Research staff will not come into face to face contact with participants. Qualitative interviews will be conducted by telephone.

11 DATA HANDLING AND RECORD KEEPING

11.1 Confidentiality

All information related to participants will be kept confidential and managed in accordance with the Data Protection Act 1998, The Caldicott Report and Caldicott Principles 1997, NHS Confidentiality Code of Practice 2003, The Freedom of Information Act 2000, The Research Governance Framework for Health and Social Care, and the conditions of Research Ethics Committee Approval. The Information Governance Toolkit will be applied to the pathway and the appropriate standards met. Any patient identifiable data, both transferred and stored, will be encrypted in line with NHS Information Governance 'Guidelines on use of encryption to protect person identifiable and sensitive information' 2008. SMS and email use will adhere to the 2010 NHS Information Governance Information Risk Management guidance with NHS.net being used for email communications both between the web tool and pharmacies, and the web tool and patients. A record of these emails will be kept as part of the patient's electronic health record. The transfer of patient identifiable data via these mediums will be minimised wherever possible. Patient electronic health records will be stored on a server provided by xxxxxxxx. The software used will be designed to securely collect the data from the online survey and ethical hacking will be used to ensure the level of security is maintained against current threats.

Semi-structured interviews with participants and the researcher will be audio recorded and labelled with a unique number. Recordings will be securely stored on password protected computers within a locked office and deleted after transcription. Transcripts will be kept in password protected computer files, and all potentially identifiable information (e.g. names) omitted from the transcripts.

11.2 Record Retention and Archiving As is required by the Research Governance Framework and Trust Policy, the research participant records will be kept for a further 20 years. After the study has ended, research data will be stored in Barts Health archive facility in Prescott Street, London E1. Access will be by formal request to this office and is only available to members of the research team. Clinical records will be stored by Barts Sexual Health Clinic according to current NHS practice.

12 LABORATORIES

Please note, as previously described, participants in the GUM and NCSP internet testing settings will undergo routine diagnostic tests in line with their routine clinical care and will only be recruited to the study once they have a positive chlamydia test result.

13 MONITORING and AUDITING

A data monitoring committee (DMC) will not be established for the exploratory study. However a steering committee which will include the Barts Health NHS Trust data information officer will be set up. The central responsibilities of this Steering committee will be to make recommendations to CI and sponsor on further conduct of this exploratory study, based on results of the monitoring procedures described below. Such recommendations could include modifying its protocol. Any such modifications should not violate the concepts behind the original study protocol. If changes in the study conduct are recommended by the steering committee, sufficient information should be provided to allow the sponsor and the CI to decide whether and how to implement them. The implementation of any steering recommendation is the responsibility of the CI and sponsor who are also free to neglect (in whole or in part) any recommendations of this Steering committee. The sponsor and the CI bear the final responsibility for the conduct of the exploratory study. This responsibility cannot be transferred to the Steering committee.

Monitoring procedure and Audit

The Steering committee will review accumulating data in an un-blinded fashion in order to monitor and audit the study conduct. Two months following the beginning of patient recruitment, the data manager will collate and clean all data necessary, and the study statistician will perform interim analysis. The study statistician will apply the statistical methods specified in the protocol to analyse study outcome measures and provide the Steering committee with data and analysis for checking.

14 STUDY COMMITTEES

Research progress will be monitored at monthly intervals by the Clinical and Public Health Workstream of *eSTI2*. This multidisciplinary working group will review research processes (and any

data produced) to ensure the exploratory studies are methodologically robust, evidence-based and delivered in a timely and ethical manner.

In addition, the exploratory studies progress will also be presented and reviewed six-monthly by the *eSTI2* Consortium Scientific Steering Committee. This committee will ensure that the exploratory studies stay within the vision of the larger Consortium project.

15 FINANCE AND FUNDING

This study is funded as part of a Consortium Grant under Phase II of the UKCRC Translational Infection Research Initiative (UKCRC G0901608)

16 INDEMNITY

We will seek sponsorship from Barts Health NHS Trust. We will require insurance and indemnity cover for all participants.

17 DISSEMINATION OF RESEARCH FINDINGS:

Study endpoints, whether negative or positive, will be reported and disseminated through the following channels:

- Research findings will be published in journals with open access within 6 months of publication (as per Wellcome Trust policy).
- Research findings will be presented at UK and international meetings orally or via posters.
- A report of the pilot findings will be freely available on the *eSTI2* Consortium website after publication in scientific journals. A link to the report will be circulated to stakeholders, collaborators and piloting sites once the report is ready.
- We will make presentations to community groups, including the study GUM clinic user groups

18 REFERENCES

1. Eng, T.R. *The eHealth Landscape: A Terrain Map of Emerging Information and Communication Technologies in Health and Health Care*. Princeton, NJ: The Robert Wood Johnson Foundation, 2001.
2. Saunders JM, et al. *Where do young men want to access STI screening? A stratified random probability sample survey of young men in Great Britain*. Sex Transm Infect. 2012; 88:427-32.
3. Lorimer K, et al. *"It has to speak to people's everyday life...": qualitative study of men and women's willingness to participate in a non-medical approach to Chlamydia trachomatis screening*. Sex Transm Infect. 2009;85:201-5.
4. National Chlamydia Screening Programme [Internet]. [Updated 2013; cited 2013 May 23]; Available from: <http://www.chlamydia Screening.nhs.uk/ps/>.
5. Electronic self testing instruments for sexually transmitted infections [Internet]. [Updated 2013; cited 2013 May 23]; Available from: <http://www.esti2.org.uk/>.
6. Medical Research Council. *Developing and evaluating complex interventions: new guidance* [Report]. [Issued 2008 Sep 29]; Available from www.mrc.ac.uk/complexinterventionsguidance.
7. Public Health England [Internet]. [Updated 2013 Feb 13; cited 2013 May 23]; Available from: <http://www.hpa.org.uk/gumcad>.
8. Estcourt C, et al. *Can we improve partner notification rates through expedited partner therapy in the UK? Findings from an exploratory trial of Accelerated Partner Therapy (APT)*. Sex Transm Infect. 2012;88:21-6.
9. General Medical Council. *Good practice in prescribing and managing medicines and devices*. Published online: GMC; 2013; Available from: http://www.gmc-uk.org/guidance/ethical_guidance/14316.asp.
10. British Association for Sexual Health and HIV. *UK National Guideline for the Management of Genital Tract Infection with Chlamydia trachomatis*. Published online: BASHH; 2006; Available from: <http://www.bashh.org/documents/65.pdf>.

11. Chlamydia Test and Treatment for 16-24s | NHS Checkyourself [Internet]. [Updated unknown; cited 2013 June 5]; Available from: <https://www.checkyourself.org.uk/>.
12. National Institute for Health and Care Excellence. PH3. *Prevention of sexually transmitted infections and under 18 conceptions: guidance*. London: NICE; 2007.
13. Merle Symonds (Principal Health Advisor at Barts and the London NHS Trust), personal communication, 2013
14. National Chlamydia Screening Programme Scorecard data. *NCSP data based on data as of 03.08.11 for the period 01.04.2011 - 30.06.2011. GUM data are for the period of Jan - Mar 2011*. Available from: <http://www.chlamydia-screening.nhs.uk/ps/>.
15. Schillinger JA et al. *Patient-delivered partner treatment with azithromycin to prevent repeated Chlamydia trachomatis infection among women: a randomized, controlled trial*. Sex Transm Dis. 2003;30:49-56.
16. Golden MR et al. *Effect of expedited treatment of sex partners on recurrent or persistent gonorrhea or chlamydial infection*. N Engl J Med. 2005;352:676-85.

Appendix IV: Main study abstract submitted to ISSTD 2015

Is an automated online clinical care pathway for people with genital chlamydia (*Chlamydia-OCCP*) within an *eSexual Health Clinic* feasible and acceptable? Proof of concept study

Authors:

Estcourt CS¹, Gibbs J¹, Sutcliffe LJ¹, Gkatzidou V², Tickle L¹, Hone K², Aicken C³, Lowndes C⁴, Harding-Esch E⁴, Eaton S⁵, Oakeshott P⁶, Szczepura A⁵, Ashcroft R¹, Hogan G⁷, Nettleship A⁸, Pinson D⁹, Sadiq ST⁶, Sonnenberg P³

¹Queen Mary University of London, ²Brunel University London, ³University College London, ⁴Public Health England, ⁵Warwick University, ⁶St George's University of London, ⁷The Doctors Laboratory, ⁸epiGenesys, ⁹The Royal Borough of Greenwich

Introduction:

UK health strategy supports self- and internet-based care. Within the eSTI² consortium (www.esti2.org.uk) we developed UK's first automated Online Clinical Care Pathway for people with genital chlamydia (*Chlamydia-OCCP*) within an *eSexual Health Clinic* (*eSHC*). *Chlamydia-OCCP* includes: STI results service; clinical consultation; electronic prescription via community pharmacy; partner notification (PN); with integral telephone helpline support. It complies with regulatory, professional, prescribing and surveillance requirements. We report on a study to assess *Chlamydia-OCCP* feasibility and acceptability as an alternative to routine care.

Methods:

Non-randomised, exploratory study to evaluate *Chlamydia-OCCP*: 21.07.14 -13.03.15

Participants: 1) chlamydia-positive untreated Genitourinary Medicine (GUM) clinic attenders; 2) people testing chlamydia-positive and negative through six National Chlamydia Screening Programme (NCSP) areas' online postal self-sampling service

Exclusions: under 16yrs; co-existing STIs, extra-genital chlamydia

Intervention: eligible people were sent an SMS message with a link to access results from *eSHC* via a password protected web-app, optimised for smartphone use. Having consented online chlamydia-positive users followed the automated *Chlamydia-OCCP*. Patients who declined received routine care.

Evaluation: treatment rate; time to treatment; PN outcomes; engagement with clinical helpline and health promotion; safety; acceptability, costs.

Results:

GUM: of 197 eligible patients, 161 accessed results online, 112 consented, 110/112 (98%) treated (72 exclusively via *Chlamydia-OCCP*, median 1day). *NCSP:* of 145 eligible patients, 133 accessed results online, 104 consented, 92/104 (88%) treated (59 exclusively via *Chlamydia-OCCP*, median 1day).

28/515 sexual partners were managed solely online. 1176/1936, (61%) NCSP chlamydia-negative people accessed results online, of whom 407 accessed online health promotion. All patients who didn't access results online were managed routinely. Patients moved effectively between online, telephone and clinic-based care.

Conclusion:

Chlamydia-OCCP is a feasible, acceptable, safe alternative to routine care for management of people with genital chlamydia. Preliminary evidence indicates comparable treatment outcomes. If linked to home testing, *Chlamydia-OCCP* offers potential for wholly remote care.